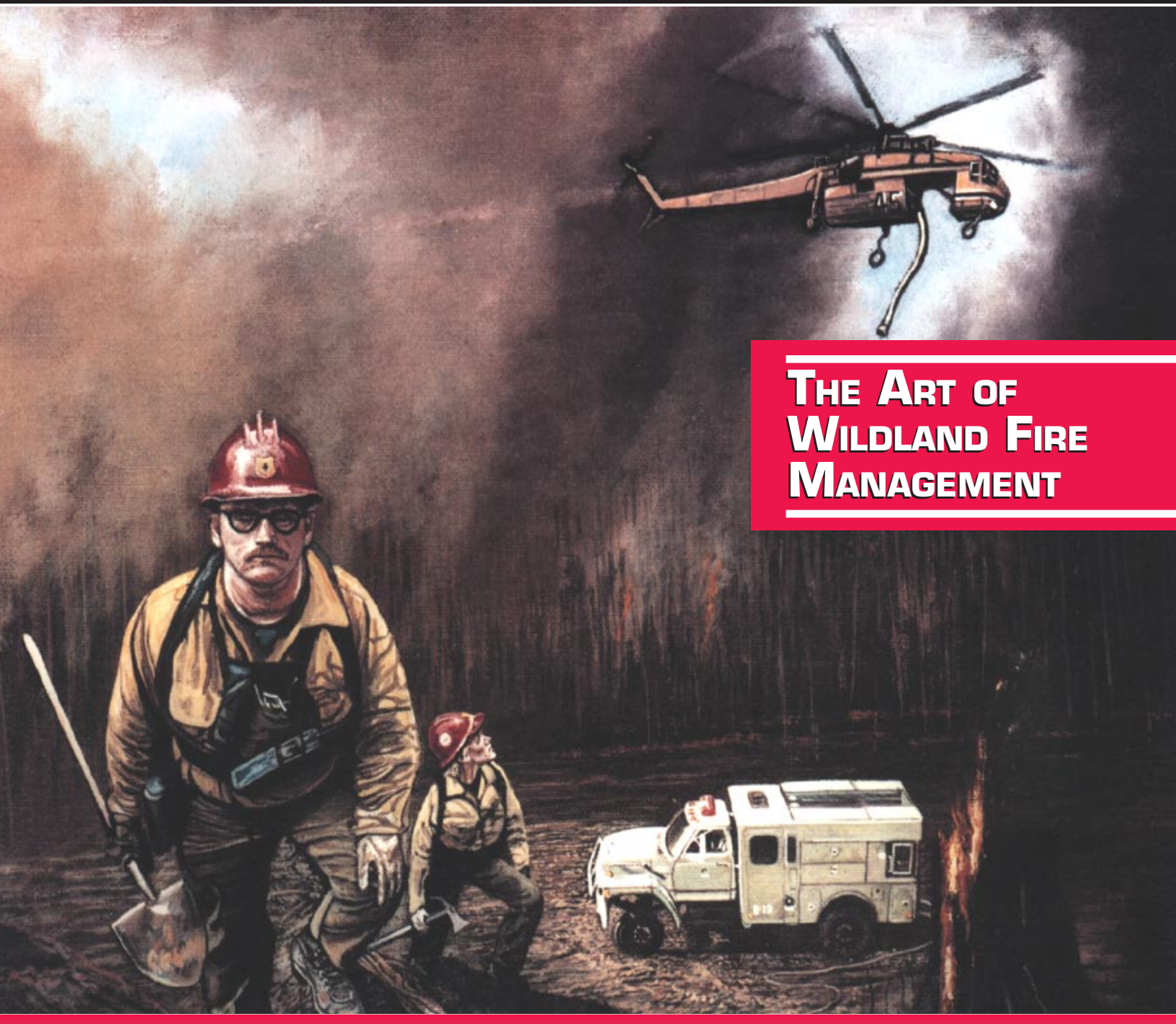
Fire Management notes

Volume 59 • No. 4 • Fall 1999



The Art of Wildland Fire Management

United States Department of Agriculture
Forest Service

Notice to readers: Long ago, *Fire Management Notes* outgrew the short formats typical of a "Notes." For years, partly at the urging of our readers, we have discussed changing the journal's name. Now, thanks to Steve Barrett, a contributor to the journal and consulting fire ecologist in Kalispell, MT, we have found the right name. Beginning with the Winter 2000 issue (volume 60(1)), *Fire Management Notes* will become *Fire Management Today*.

Editor's note: This issue of *Fire Management Notes* celebrates the art of wildland fire management, acknowledging our debt to all the artists over the years who have used their talents to illustrate and commemorate wildland firefighting, fire use, and other forms of wildland fire management.

- Our featured artist in this issue is Patrick Michael Karnahan, whose paintings capture the drama of wildland firefighting. (See page 4.)
- April Baily's birthday tribute to Smokey Bear acknowledges 55 years of one of the most imaginative and far-reaching artistic campaigns in our Nation's history, led by the USDA Forest Service in partnership with The Ad Council. (See page 8.)
- Finally, Steve Barrett's allegorical sketch of wildland burning by Native Americans, a first step into the realm of fiction for *Fire Management Notes*, uses story-telling humor to show the ties between past and present in wildland fire management. (See page 40.)

The artistic framework for this issue, which begins with visual art and ends with literary fiction, is designed to illustrate the multidimensionality of wildland fire management as a deeply human endeavor. We welcome you to submit your fire-related art for possible publication in *Fire Management Notes*. In particular, we invite you to submit your photographs for evaluation in the photo contest announced in this issue (see page 43). In tribute to the large and growing role of art in wildland fire management today, a future issue of *Fire Management Notes* will feature the winning photos.

Fire Management Notes is published by the Forest Service of the U.S. Department of Agriculture, Washington, DC. The Secretary of Agriculture has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department.

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Fire Management Notes is available on the World Wide Web at <http://www.fs.fed.us/land/fire/firenote.htm>.

Fire Management notes

Volume 59 • No. 4 • Fall 1999

On the Cover:

"Siege of '96," a painting by Patrick Michael Karnahan, commemorates one of the worst fire seasons in California's history—and the Nation's. In 1996, more than 6 million acres (2.4 million ha) burned nationwide, including 666,000 acres (270,000 ha) in California. In early August, a week of abnormally high temperatures in California was followed by lightning storms, igniting hundreds of fires. Ninety-three fires escaped initial attack and consumed more than 366,000 acres (148,000 ha) within 3 weeks. By mid-August, firefighters from across the Nation were converging on California. Karnahan's depiction of hotshots, an engine, and a helitanker honors the various ground and aerial firefighting resources that were pitted against the flames during the Siege of '96. Photo: Karl Perry, USDA Forest Service, Washington, DC, 1999. (For more of Karnahan's artwork, see the story beginning on page 4.)

The FIRE 21 symbol (shown below and on the cover) stands for the safe and effective use of wildland fire, now and in the 21st century. Its shape represents the fire triangle (oxygen, heat, and fuel). The three outer red triangles represent the basic functions of wildland fire organizations (planning, operations, and aviation management), and the three critical aspects of wildland fire management (prevention, suppression, and prescription). The black interior represents land affected by fire; the emerging green points symbolize the growth, restoration, and sustainability associated with fire-adapted ecosystems. The flame represents fire itself as an ever-present force in nature. For more information on FIRE 21 and the science, research, and innovative thinking behind it, contact Mike Apicello, National Interagency Fire Center, 208-387-5460.

Firefighter and public safety is our first priority.

Contents

Short Features

Patrick Michael Karnahan: An Artist on the Firelines*

Hutch Brown

Art is often associated with ethereal subjects, not with grim reality—and certainly not with the grimy drudgery firefighters often face on the fireline. But not for Patrick Michael Karnahan. For more than 20 years, Karnahan has used his unique artistic talents to commemorate the heroic efforts and sacrifices made by wildland firefighters and to dramatize the ongoing need for sound wildland fire management.

Karnahan knows a lot about wildland fire. For 15 years, he worked for the USDA Forest Service as a seasonal firefighter and later as a graphic artist and public affairs specialist. He remains under contract to prepare paintings for Forest Service posters and publications. His paintings, based on years of personal experience on the firelines, are full of highly accurate detail. They also reflect his emotional commitment to wildland firefighting and to conserving our public wildland treasures.

Karnahan spent most of his Forest Service career in the Sierra Nevada, CA. He worked as a firefighter and in fuels management on the Eldorado, Plumas, and Sequoia National Forests; and in recreation on the San Bernardino National Forest. In addition, he designed posters for public education on the National Forest System and implemented visual interpretation programs for the Stanislaus National Forest. He has also done design and interpretive work for California's Department of State Parks and Recreation.

Karnahan has been oil painting since he was 8 years old. In addition to painting wildlands, Karnahan has been capturing the history of the American railroads on canvas for more than 20 years. He has completed a calendar on American railroads, and his artwork has been featured on numerous book and magazine covers. He also promotes art education for children in local schools. "It's satisfying," he says. "Usually, I'll sell my paintings and won't see them again. What I'm doing becomes part of the community."

But that's not all. Karnahan also plays and writes music for the Black Irish Band, which he founded in 1989 in his home town

> Karnahan's paintings, based on years of wildland firefighting experience, are full of highly accurate detail.

Artist Patrick Michael Karnahan poses with his work "Into the Unknown." Photo: Courtesy of Patrick Michael Karnahan, Sonora, CA, ©1994.

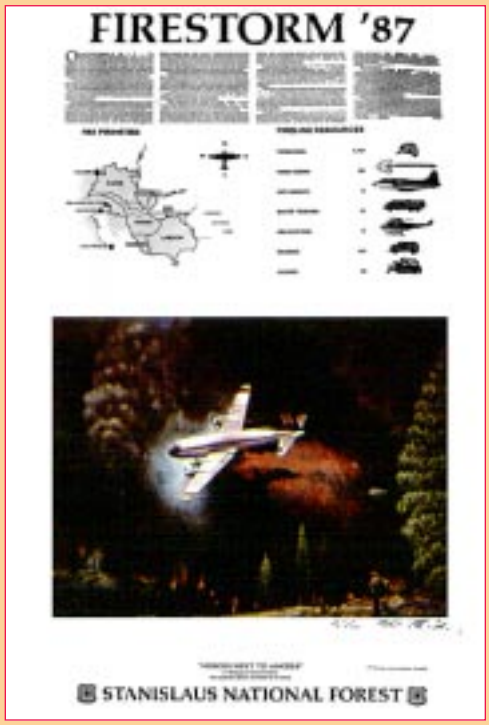
Hutch Brown is the editor of Fire Management Notes, *Arlington, VA.*

* This article is based on reports in *The Sacramento Bee,* 24–26 October 1997; and the *Sonora Union Democrat,* 9 September 1988, 12 September 1997, and 25 September 1998.

of Sonora, CA. The band plays old and new music in many styles, including Celtic, Sicilian, Spanish, railroad, Gold Rush, and maritime. "I write songs about people and places and events that influence my life," says Karnahan, "and I'm fascinated by history."

That history, of course, includes wildland firefighting. One of Karnahan's songs is about the Mann Gulch Fire, in which 13 smokejumpers lost their lives in a 1949 blowup on a Montana hillside. After the disaster, which Karnahan calls a modern tragedy, the Forest Service revised its standards for wildland firefighting. Karnahan felt compelled to write a song about what happened. "People are crying out, 'Remember us, remember our time,'" he says. "To me, we all connect together. That's what makes us who we are." ■

Firestorm and Aftermath



The Forest Service posters "Firestorm '87" and "Up From Ashes" feature paintings by Patrick Michael Karnahan commemorating the Stanislaus Complex Fire in 1987 on California's Stanislaus National Forest. The fire complex burned more than 147,000 acres (59,000 ha) and took massive firefighting resources to control, including 134 hand crews (more than 2,000 firefighters) and 13 airtankers.

The painting in the poster on the left suggests the scope and intensity of the fire. A DC–6 airtanker swoops over an exhausted firefighter toward a blazing lookout tower, representing the various firefighting and fire detection resources used today and in the past. Dimly outlined in the billowing smoke are the features of David Erickson, a firefighter killed on the firelines by a falling tree. Karnahan also created a roadside monument to Erickson that overlooks the spot where he died.

The poster on the right shows the aftermath of the fire. Smokey watches a mother and child plant a seedling on the devastated forest, symbolizing hope and rebirth—and a subtle warning for the future. Both paintings illustrate the emotion Karnahan invests in his work, which functions in these posters not only to aesthetically please, but also to give pause to reflect. Photos: Courtesy of Patrick Michael Karnahan, Sonora, CA, ©1995 and ©1989.

The Drama of Wildland Firefighting

These paintings illustrate Patrick Michael Karnahan's attention to detail in depicting wildland firefighting. "Fight for Fullen Road" (left) commemorates pilot Roger Stark, who died while flying an S–2 airtanker on the 1992 Old Gulch Fire, Stanislaus National Forest, CA. Two weeks of backfires set by the California Department of Forestry and Fire Protection (CDF) failed to stop the Old Gulch Fire, which jumped Fullen Road and threatened the town of Arnold, CA. The Forest Service joined the fray, and a backfire set by Fire Management Officer Bob Kress finally succeeded in turning the tide and saving the town. In a testimony to interagency wildland fire management, Karnahan's painting shows a Forest Service engine crew working side by side with a crew from the CDF to hold a fireline, while a CDF S–2 airtanker overhead drops retardant along the flank of the fire.

"Into the Unknown" (right), a tribute to Forest Service hotshot crews, depicts the Stanislaus Hotshots on the Stanislaus National Forest, along with the tools they use and the equipment they carry. The helitanker hovering overhead represents the vital role that aircraft play in supporting firefighters on the ground. Photos: Karl Perry, USDA Forest Service, Washington, DC, 1999.

Karnahan's paintings are full of history, functioning not only to aesthetically please, but also to commemorate the sacrifices wildland firefighters make to protect lives, property, and wildland resources.

A Tribute to Wildland Fire Aviation

Patrick Michael Karnahan's fascination with history—including the history of American machines—emerges in these paintings of airtankers dropping retardant on wildland fires. The Consolidated PB4Y2 Privateer (top) was built for World War II as a long-range Navy bomber. Used since the 1960's as a type 2 airtanker, the PB4Y2 has a limited future because replacement parts are hard to find. The Boeing KC–97 (bottom), originally designed as a military transport, has served as a type 1 airtanker in Alaska. Photos: Courtesy of Patrick Michael Karnahan, Sonora, CA, ©1997 and ©1995.

A Birthday Letter to Smokey

April Baily

Dear Smokey Bear,

Realizing that you celebrated your 55th birthday on August 9, 1999, I wanted to extend belated congratulations. You've done an outstanding job of preventing human-caused wildland fires!

I recently read your biography, *Smokey Bear 20252—A Biography*, by William Clifford Lawter, Jr. What a story it is! I was impressed by the efforts of all the people who helped make you the symbol of fire prevention. William Bergoffen, for example, in his position in the USDA Forest Service's Division of Information and Education, was instrumental in your appearance today. To help you look more like the people you were talking to, he suggested that you wear dungarees. As Mr. Lawter says in his book, Bill Bergoffen became known thereafter as "the man who put the pants on Smokey."

Some wonderful people were associated with you in your early years. For example, who could forget Albert Staehle, who's credited with the very first poster of Smokey Bear? Another special man was Rudy Wendelin, an artist of national renown, who not only created some of your best posters, but also guided and protected your development as you grew into the character recognized today almost as widely as Santa Claus! James Hansen was the man who drew national attention to your prevention campaign with his poster of you kneeling, paws touching, with the caption, "… and please make people careful." Other artists, such as Harry Rossoll, also helped make you the national symbol you are today.

But what's a bear without a voice? In 1947, Jackson Weaver, announcer for radio station WMAL in Washington, DC, gave you your voice. Mr. Weaver became so closely associated with you that his 1995 death was announced as the passing of "the Voice of Smokey Bear."

I know lots of people lately have criticized your prevention message, saying that the years of prevention have actually made the fire problem worse by allowing fuels to build up to the point where a conflagration is inevitable when a spark is struck. But I know that your message was always aimed at keeping people from carelessly starting the fires that destroy not just trees, but also the homes of people who share your wildlands. Don't get discouraged. Your message is just as relevant today as ever!

Most of the people who helped you get started have passed on. But those of us still around say, "Thank you, Smokey Bear. Keep reminding us that it's OUR job to prevent carelessness from causing wildland fires!"

Your friend,
/s/ April Baily

April J. Baily is the Federal Excess Personal Property program officer for the USDA Forest Service, Fire and Aviation Management, Washington, DC; and the general manager of Fire Management Notes.

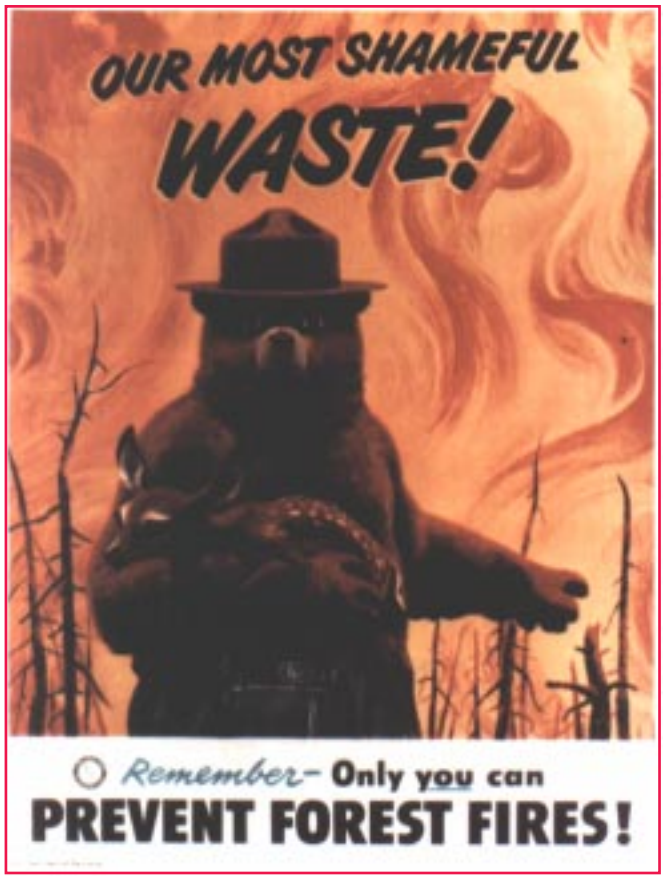
The first poster of Smokey Bear was prepared in 1944–45 from drawings by Albert Staehle, a renowned animal artist. The bear was chosen over a squirrel, an owl, and a chipmunk, also drawn by Staehle, for a wildland fire prevention campaign that would appeal especially to children. Photo: USDA Forest Service, Washington, DC.

James Hansen, a well-known animal illustrator and sculptor, modified Albert Staehle's early Smokey into a more human-looking bear. Hansen's 1948 poster of a kneeling, bare-headed Smokey resonated widely with the American public. Photo: USDA Forest Service, Washington, DC.

Forest Service artist Rudy Wendelin is widely credited with putting the finishing touches on Smokey. Shown here at his desk in 1960, Wendelin devoted much of his time—even after his retirement in 1973—to drawing Smokey Bear. Photo: Courtesy of National Agricultural Library, Special Collections, Forest Service Photograph Collection, Beltsville, MD.

"America's best animal friend is a sturdy brown bear named Smokey. Not since the early days of Mickey Mouse and Bambi has any cartooned animal made such an impact on Americans."

–*Newsweek* cover story, quoted in *Fire Control Notes*, October 1952



In the 1950's and 1960's, artists such as James Hansen, Chuck Kuderna, Harry Rossoll, and Rudy Wendelin refined Smokey's appearance to what it is today. For example, Smokey's name appeared on his belt buckle (left) and hatband (right). The 1950 poster on the left uses the Bambi theme, ever popular with children, and the "red" theme of a firestorm in the background to dramatize the destruction caused by careless fire use. By contrast, the 1964 poster on the right uses a "green" theme (above) to promote the benefits of firesafe practices and a "black" theme (below) to show the costs of carelessness with fire. The Cooperative Forest Fire Prevention Campaign frequently alternated among these themes in its posters. Photos: USDA Forest Service, Washington, DC.

Smokey Prevents a Fire*

In 1951, anglers on northern California's McCloud Ranger District, Shasta National Forest, stopped in a nearby town to make some purchases on their way home to San Francisco. In the store window, they noticed a poster showing Smokey standing in front of a raging wildland fire and saying, "You Can Stop This Shameful Waste!" The poster made the anglers wonder whether they had completely extinguished their own campfire. Returning to their abandoned campsite, they found that smoldering coals had already ignited the thick pine duff near the campfire. The fire was beginning to spread, but the anglers managed to put it out. Then they reported the entire incident at the ranger station. "If the fire had gotten away under those burning conditions," said District Ranger Earl F. Sullaway, "it could have easily blackened a great many acres. Smokey Bear sure did his part in keeping California green and golden!"

**Based on a report in* Fire Control Notes *13(2): 41.*

"The story of how Smokey was born and how he grew is a prize example of wholesome and energetic cooperation between government and business."

–*Newsweek* cover story, quoted in *Fire Control Notes*, October 1952

William Bergoffen, who served in the USDA Forest Service's Division of Information and Education in Washington, DC, from 1940 until his retirement in 1967, was part of a team that first developed the idea for Smokey Bear in August 1944. One of several people who helped refine early drawings of Smokey by adding humanizing touches, Bergoffen suggested Smokey's dungarees. In 1967, Forest Service artist Rudy Wendelin acknowledged Bergoffen's role in creating Smokey Bear with a humorous retirement card for "the man who put the pants on Smokey." Photo: Courtesy of National Agricultural Library, Special Collections, Forest Service Photograph Collection, Beltsville, MD.

By the 1970's, Smokey was so well known nationwide that it was no longer necessary for his posters to state any explicit message against careless fire use. In this 1975 illustration (which includes the contemporaneous "Thanks for Listening!" Smokey poster in the background, whimsically altered), Rudy Wendelin pays tribute to the live bear identified with Smokey, an orphaned black bear cub rescued in 1950 after the Capitan Gap Fire on the Lincoln National Forest, NM. Amid great fanfare, the cub was named after Smokey and transferred to the National Zoo in Washington, DC. When he died in 1976, another young bear replaced him for awhile as "the living symbol of Smokey Bear." Photo: USDA Forest Service, Washington, DC.

Contributors Wanted

We need your fire-related articles and photographs for *Fire Management Notes*! Feature articles should be about 1,500 to 2,000 words in length. We also need short items of about 100 to 200 words. Subjects of articles published in *Fire Management Notes* include:

Aviation
Communication
Cooperation
Ecosystem management
Education
Equipment and technology
Fire behavior
Fire ecology
Fire effects
Fire history
Fire use (including prescribed fire)
Fuels management
Firefighting experiences
Incident management
Information management (including systems)
Personnel
Planning (including budgeting)
Preparedness
Prevention
Safety
Suppression
Training
Weather
Wildland–urban interface

To help prepare your submission, see "Guidelines for Contributors" in this issue.

Guidelines for Contributors

Editorial Policy

Fire Management Notes (*FMN*) is an international quarterly magazine for the wildland fire community. *FMN* welcomes unsolicited manuscripts from readers on any subject related to wildland fire management.

Submission Guidelines

Submit manuscripts to either the general manager or the editor at:

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Attn: April J. Baily, F&AM Staff
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If you have questions about a submission, please contact the editor, Hutch Brown.

Paper Copy. Type or word-process the manuscript on white paper (double-spaced) on one side. Include the complete name(s), title(s), affiliation(s), and address(es) of the author(s), as well as telephone and fax numbers and e-mail information. If the same or a similar manuscript is being submitted elsewhere, include that information also. Authors who are affiliated should submit a camera-ready logo for their agency, institution, or organization.

Style. Authors are responsible for using wildland fire terminology that conforms to the latest standards set by the National Wildfire Coordinating Group under the National Interagency Incident Management System. *FMN* uses the spelling, capitalization, hyphenation, and other styles recommended in the *United States Government Printing Office Style Manual*. Authors should use the U.S. system of weight and measure, with equivalent values in the metric system. Try to keep titles concise and descriptive; subheadings and bulleted material are useful and help readability. As a general rule of clear writing, use the active voice (e.g., write, "Fire managers know…" and not, "It is known…"). Provide spellouts for all abbreviations. Consult recent issues (on the World Wide Web at <http://www.fs.fed.us/land/fire/firenote.htm>) for placement of the author's name, title, agency affiliation, and location, as well as for style of paragraph headings and references. Inhouse editing can be expedited if authors have their manuscript reviewed by peers and by someone with editing skills. Please list the name(s) of reviewer(s) and/or the editor when submitting manuscripts.

Tables. Tables should be typed, with titles and column headings capitalized as shown in recent issues; tables should be understandable without reading the text. Include tables at the end of the manuscript.

Photos and Illustrations. Figures, illustrations, overhead transparencies (originals are preferable), and clear photographs (color slides or glossy color prints are preferable) are often essential to the understanding of articles. Clearly label all photos and illustrations (figure 1, 2, 3, etc.; photograph A, B, C, etc.). At the end of the manuscript, include clear, thorough figure and photo captions labeled in the same way as the corresponding material (figure 1, 2, 3, etc.; photograph A, B, C, etc.). Captions should make photos and illustrations understandable without reading the text. For photos, indicate the "top" and include the name and affiliation of the photographer and the year the photo was taken.

Electronic Files. Please label all disks carefully with name(s) of file(s) and system(s) used. If the manuscript is word-processed, please submit a 3-1/2 inch, IBM-compatible disk together with the paper copy (see above) as an electronic file in one of these formats: WordPerfect 5.1 for DOS; WordPerfect 7.0 or earlier for Windows 95; Microsoft Word 6.0 or earlier for Windows 95; Rich Text format; or ASCII. Digital photos may be submitted but must be at least 300 dpi and accompanied by a high-resolution (preferably laser) printout for editorial review and quality control during the printing process. Do not embed illustrations (such as maps, charts, and graphs) in the electronic file for the manuscript. Instead, submit each illustration at 1,200 dpi in a separate file using a standard interchange format such as EPS, TIFF, or JPEG (EPS format is preferable, 256K colors), accompanied by a high-resolution (preferably laser) printout. For charts and graphs, include the data needed to reconstruct them.

Release Authorization. Non-Federal Government authors must sign a release to allow their work to be in the public domain and on the World Wide Web. In addition, all photos and illustrations require a written release by the photographer or illustrator. The author, photo, and illustration release forms are available from General Manager April Baily.

Interagency Teams Prevent Fires From Alaska to Florida

Judith K. Kissinger

In spring 1998, everything pointed to a severe fire season in Texas. Temperatures were high and rainfall was scant; the moisture in green vegetation was half of what it should have been. The Keetch–Byram Drought Index, a measure of soil moisture, was far above the normal spring range of 200 to 300 and already approaching the danger zone above 600.

In May 1998, realizing the potential for catastrophic wildland fires, the Texas Forest Service mobilized a national cooperative wildland fire prevention/education team to augment the agency's own teams. From its main office in the capital city of Austin, the national team quickly established satellite offices in Waco, San Antonio, and Dallas–Ft. Worth. Each satellite unit had a public information officer and two fire prevention specialists. The team's strategy was to:

- Inform Texas residents and visitors of the extreme fire danger,
- Generate interest in preventing wildland fires, and
- Bring about actions that could reduce the incidence of human-caused fires.

The bottom line was to protect lives, property, and natural resources (see sidebar).

Judy Kissinger is a public affairs specialist for the USDA Forest Service, Office of Communication, Washington Office, Washington, DC; and a national instructor for fire prevention/education workshops.

What Are Cooperative Wildland Fire Prevention/Education Teams?

National cooperative wildland fire prevention/education teams are available to support any geographic area preceding and during periods of high fire danger or fire activity. Severity dollars are appropriate for use in mobilizing a team.

Purpose

The purpose of national fire prevention/education teams is to help local units prevent human-caused wildland fires by working together to:

- Complete fire risk assessments;
- Determine the severity of the situation;
- Facilitate community awareness and education in fire prevention, including prescribed burning;
- Coordinate announcement of interagency restrictions and closures;
- Coordinate fire prevention efforts with the public, special target groups, State and local agencies, and elected officials;
- Promote public and personal responsibility regarding fire prevention in the wildland–urban interface; and
- Develop fire protection plans.

Benefits

National fire prevention/education teams can help:

- Reduce the loss of human life and property;
- Reduce resource losses;
- Reduce the cost of suppression; and
- Improve interagency relations.

Organization

Each national fire prevention/education team consists of a team leader, an operations specialist, a public affairs officer, one or more fire prevention specialists, and trainees or other team members (such as a finance officer or logistics specialist) as the situation warrants. Trained interagency fire prevention personnel can be mobilized through normal dispatch channels (see National Interagency Mobilization Guide, section 22.5.10).

Texas Teamwork

The team worked in tandem with the Texas Forest Service, the city of Austin, Travis County, and other entities under the direction of an interagency overhead team, which also directed suppression efforts—a unique combination for the Incident Command System. Employees also participated from the U.S. Department of the Interior's (USDI's) Bureau of Land Management (BLM) and National Park Service (NPS) and from the States of Alaska, Idaho, and New Mexico. Team members rotated every 2 to 3 weeks, usually one at a time to ensure continuity. The Texas Forest Service provided people to work with the team toward common goals in fire safety and to provide continuity for programs when the national team was demobilized.

The team focused on protecting homes in the wildland–urban interface (figs. 1 and 2) and (prior to the Fourth of July) on fireworks hazards, with secondary emphases on safe fire use by campers, hikers, smokers, and tourists. Among other things, the team:

- Presented programs on how to defend property against wildland fire to homeowner associations, 4–H leaders, fire chief associations, county councils, and other community groups;
- Created and released statewide public service announcements and news releases, including a media campaign on fireworks called "Don't Blow It!";
- Developed and distributed more than 300,000 interagency flyers, brochures, and other products (some in both English and Spanish) to homes, libraries, museums, and other civic locations;

The national fire prevention/education teams have a proven record of preventing fires in States from Alaska to Florida under conditions of extreme drought and high temperatures.

- Participated in community outreach programs and special events for the public;
- Contacted more than 200 fire departments and met with city councils, fire chief associations, homeowner associations, and county officials to plan communication campaigns in their communities;
- Purchased weatherproof signs, such as "No Fireworks" and "Please Clear Around Your Home," and distributed them to local fire departments, county agencies and parks, homeowner associations, the Texas Forest Service, and the city of Austin for posting along roads and highways;
- Distributed existing local publications at meetings, presentations, and events; and
- Developed partnerships with businesses, utility companies, and Federal, State, and local agencies.

The challenge of a fire prevention team is not only to raise public awareness, but also to change behavior. For example, homeowners must take responsibility for protecting their own homes and neighborhoods from wildland fire; smokers should smoke in their cars and use their ashtrays instead of strolling through forests or grasslands with lit smoking materials; fireworks vendors can remove especially risky items from their inventories; and campers can choose not to light campfires.

Figure 1—*In 1998, the national fire prevention/education team in Texas helped develop a project to assess homes in the wildland–urban interface for risk of wildland fire. This homeowner, who volunteered for the project, helps by pruning dead branches from a tree, thereby reducing the quantity of ladder fuels on her property. Photo: Judy Kissinger, USDA Forest Service, Washington Office, Washington, DC, 1998.*

All the individuals interviewed in States that have used the national fire prevention/education teams wanted the teams mobilized again during future severe fire situations—a sign of their success.

Figure 2—*Workers in the wildland–urban interface project (top) prepare to clear away fuels and widen a driveway to accommodate emergency vehicles. After work is complete (bottom), the home in the background is far more defensible from wildland fire. For homeowners who participated in the project, cooperating government agencies (including the Texas Forest Service, the USDA Forest Service, the Lower Colorado River Authority, the Federal Corrections Institute, Bastrop City, and Bastrop County) cut down dead trees, removed brush and leaves near houses, trimmed branches overhanging roofs, thinned highly inflammable vegetation, and performed other work to create defensible space around affected houses. Photo: Judy Kissinger, USDA Forest Service, Washington Office, Washington, DC, 1998.*

Origins—Teaming Up in the Southwest

The first national fire prevention/education team was launched in 1996 in the Southwest. Unusual conditions—below-average precipitation, above-average temperatures, and high winds—portended a severe fire season for the region. Realizing the danger, the Southwest Area Fire Management Board, an interagency coalition of land managers primarily devoted to regional fire suppression, decided to give unprecedented emphasis to fire prevention. The board considered it critical to prevent human-caused wildland fires to protect lives, property, and natural resources.

The first national fire prevention/education team included representatives from the USDA Forest Service; the USDI Bureau of Indian Affairs, BLM, NPS, and U.S. Fish and Wildlife Service; and the States of Arizona and New Mexico. The same Federal agencies have since cooperated on national fire prevention/education teams in other States. The objectives for the Southwest team included taking an interagency approach to all fire prevention activities, such as the strategies used and products released to audiences and the media in the Southwest. In its messages, the team emphasized the use of prescribed fire and the responsibility of owners to make their properties safer from wildland fire.

The team reported to the Southwest Area Fire Management Board. After setting up an overhead unit in Santa Fe, NM, the team offered to establish satellite units of fire prevention specialists in 11 geographic zones throughout Arizona, New Mexico, and west Texas. Ten of

the 11 zones took advantage of the offer. The overhead team oriented and prepared the fire prevention specialists for their roles in their assigned zones and then supported the satellite units in their zones. Based on the Southwest team's experience, subsequent national fire prevention/education teams have included a public affairs officer in each satellite unit.

The Arizona Interagency Fire Prevention and Information Center, located in Phoenix, was a major hub for the media in Arizona. Working closely with the Arizona center, the Southwest team produced its own products and conducted its own campaigns from its base in New Mexico. Because of its active approach to working with the public and media, the Arizona center was key as a springboard for additional fire prevention activities.

The activities of the Southwest team included:

- Developing wildland–urban interface plans;
- Delivering campfire programs and school curriculum materials;
- Designing and producing numerous interagency prevention handout materials;
- Going door to door to tell homeowners, realtors, and fire departments how to make communities defensible against wildland fire;
- Improving media contacts for wildland fire prevention; and
- Improving communication across agency lines.

Teams in Other States

Alaska. At the same time the Southwest team was operating in 1996, fire in the wildland–urban interface was becoming a growing concern in Alaska, where many homes and recreational cabins are scattered across wildlands. The Millers Reach No. 2 Fire, which destroyed 350 structures, underscored the need for a coordinated fire prevention program for residents, firefighters, and emergency services personnel in the wildland–urban interface. To promote coordination between fire protection agencies and community members, the Alaska Wildland Fire Coordinating Group mobilized a national fire prevention/education team. The Alaska team split into two groups, with three members going to Fairbanks and three to the Anchorage/Kenai Peninsula area. These teams:

- Presented programs on defensible space and wildland safety;
- Met with the governor, local commissioners, and fire protection and other officials;
- Conducted home fire prevention assessments;
- Presented workshops for homeowners; and
- Conducted "train-the-trainer" workshops for fire protection personnel so that a program of wildland–urban interface fire protection and prevention would continue after the national team's departure.

Florida. In August 1998, well after a catastrophic fire season was already under way, the State of Florida mobilized a national fire prevention/education team. Some 45,000 people had been evacuated from their homes, and many found nothing but ashes when they were allowed to return. The Florida team emphasized the benefits of prescribed burning and fire safety in the wildland–urban interface. In addition, the team assisted the State in developing a 3-year fire prevention plan. Six individuals participated on the team for varying periods of time over 21 days. Other teams in 1998 went to Colorado, New Mexico, and Utah for shorter periods of time.

Teamwork Success

In their short history, the national fire prevention/education teams have a proven record of preventing fires in States from Alaska to Florida under conditions of extreme drought and high temperatures. In the Southwest, during the 60 days the team operated there in 1996, 31 team members devoted 663 person-days at a cost of $180,000. With fire suppression costs now reaching $1 million per day on some fires, if the team prevented just 1 day of fire suppression, the savings it achieved would easily have covered its costs. In fact, fire statistics indicate that the team's educational efforts reduced human-caused fires by up to 25 percent (fig. 3)—an enormous cost saving for taxpayers.

In Texas, the number of human-caused wildland fires steadily climbed statewide from March 3 to May 31, 1998. After the national fire prevention/education team became operational in late May, the number of human-caused fires steadily dropped until August (fig. 4), even though heat and drought conditions worsened. The correlation of a decline in fires with team activities strongly suggests that the team succeeded in protecting lives, property, and natural resources from wildland fires.

After the Texas fire season, key persons such as community leaders, local fire officials, and county judges were interviewed about the national fire prevention/education team's efforts. All expressed great satisfaction with the team's work. They were especially pleased with the work that

the team did directly with local fire departments, communities, and neighborhoods. They confirmed that such activities significantly diminished the number of fires and acres burned, reducing suppression costs and losses of property and natural resources. A strong measure of success for the prevention teams is the desire expressed in the States that have used them to request them again. All the individuals interviewed wanted prevention teams mobilized during future severe fire situations.

Fire Prevention/ Education Workshops

Following the 1996 fire season, fire prevention and public affairs specialists formed a national fire prevention cadre to develop a training workshop for mobilizing and operating national fire prevention/education teams. The cadre has conducted four workshops. Workshop graduates are listed as qualified fire prevention/education specialists or public affairs specialists trained to work with prevention teams. The roster of these specialists is invaluable in locating qualified members for prevention teams. Others who are well qualified in fire prevention theory or are experienced public affairs practitioners but have not yet attended a workshop are also eligible to join a team and might be asked to do so.

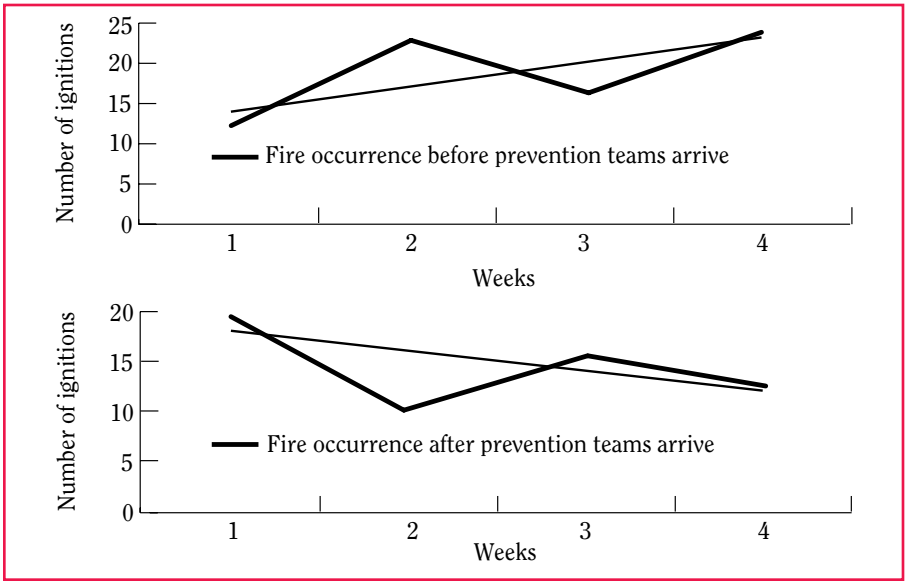


Figure 3—*The number of human-caused wildland fire ignitions per week in the Southwest before (top) and after (bottom) mobilization of a national fire prevention/education team. Figures suggest that the team's efforts reduced unwanted ignitions by up to 25 percent.*

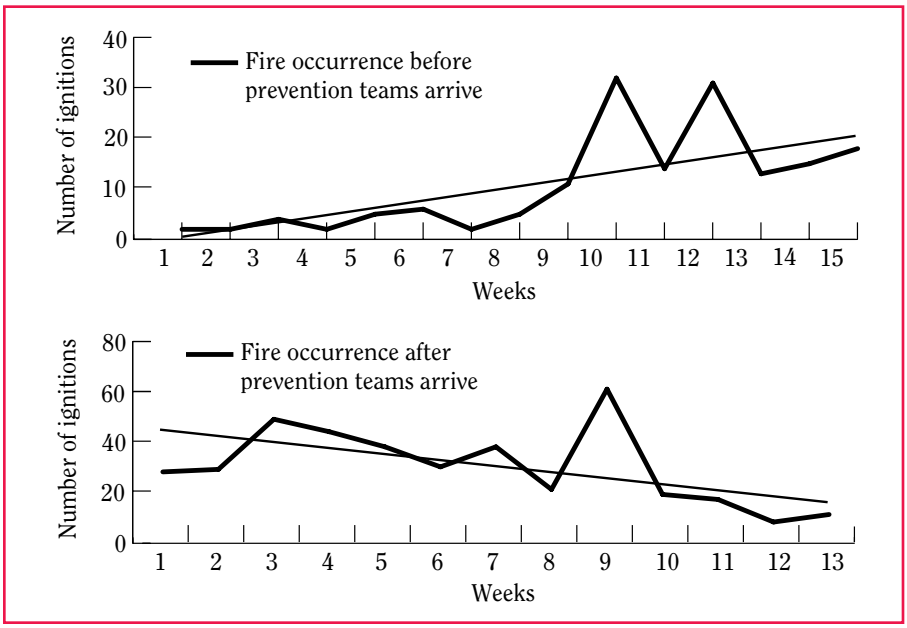


Figure 4—*The number of human-caused wildland fire ignitions per week in Texas before (top) and after (bottom) mobilization of a national fire prevention/education team. After the team intervened, the rising trend in unwanted ignitions underwent a dramatic reversal and began a steady decline.*

The cadre also developed a prevention kit for those assigned to national fire prevention/education teams. The kit contains brochures, pamphlets and videos, wildland fire prevention guidebooks, a Smokey Bear graphic art CD, a teacher's study guide, children's activity books, an instructor kit with slides and handouts for communities, and catalogs of additional items.

A trained national fire prevention/education team can be mobilized through normal dispatch channels. Mobilization of a team is outlined in the National Interagency Mobilization Guide (section 22.5.10) and can be ordered through the Geographic Area Coordination Centers (GACC's). GACC locations are posted on the Internet at <www.nifc.gov/news/geomap.html>. For more information on the teams, contact Judy Kissinger, USDA Forest Service, Office of Communication, Rm. 2 Cen. Yates, P.O. Box 96090, Washington, DC 20090-6090, 202-205-1094 (voice), 202-205-0885 (fax). ■

Why Burn Wilderness?

Stephen W. Barrett

Controversy has arisen over a recent proposal by the USDA Forest Service to use prescribed fire in central Idaho's Salmon River Canyon. For many years, fires have been promptly extinguished in much of the Salmon River Canyon, especially near agency infrastructure and private inholdings within wilderness boundaries. As a result, fire-dependent forests have suffered.

Over the next 10 years, the Forest Service plans to burn vegetation in a number of drainages heavily affected by fire exclusion. About 60 percent of the 2-million-acre (800,000-ha) planning area is multiple-use land, and the rest is in the Frank Church–River of No Return Wilderness. The proposal has been criticized by loggers for "wasting timber" and by some environmentalists for "impactive" wilderness management.

Fire History in Central Idaho

The environmental impact statement for the project was based largely on my fire history studies, begun in 1983 (Barrett 1987; Barrett 1988a; Barrett 1988b; Barrett 1994a; Barrett 1994b; Barrett 1998; Brown et al. 1994). Results are alarming:

- Although many acres have burned in the Salmon River Canyon in recent decades, the data still show a fourfold reduction in area fire occurrence from previous levels.

Steve Barrett, a consulting fire ecologist in Kalispell, MT, has studied fire history in many parts of the northern Rocky Mountains for the past 20 years.

The goal of prescribed fire is not to supplant lightning fires, but rather to ease their inevitable return to wilderness areas.

Researchers sample fire history from a fire-scarred old-growth ponderosa pine. Because motorized equipment is generally forbidden in wilderness areas, researchers use a crosscut saw (top) to remove a thin slice from the tree (center) without seriously damaging the tree. Such samples often reveal 300 to 500 years of fire history (bottom). Photos: Courtesy of Steve Barrett, Kalispell, MT, ©1983.

- Data from 76 stands in the nonlethal fire regime suggest that underburns occurred about every 17 years before 1900. However, these stands have not burned for the past 84 years, on average.
- Whereas about 50 percent of the canyon's forests experienced frequent low-intensity fires before 1900, that total has declined to 33 percent. By contrast, the stand-replacing fire regime has increased from an estimated 20 percent of the area historically to about 50 percent today.

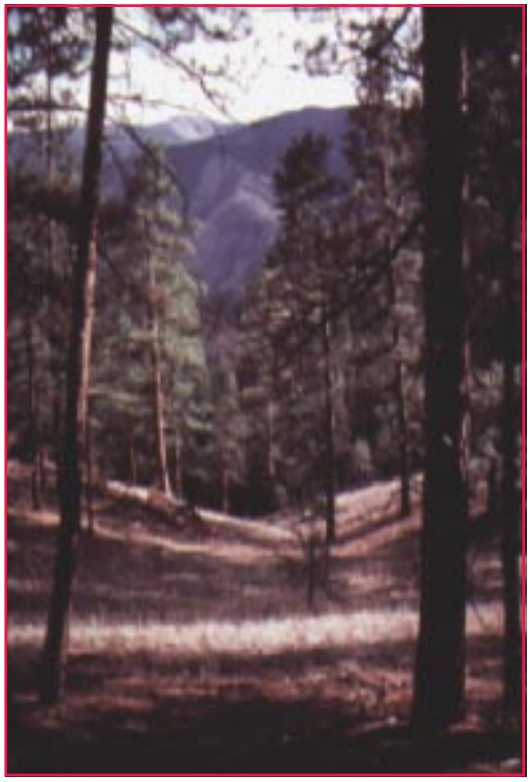
These results clearly bode ill for old-growth ponderosa pines and associated species. Without frequent low-intensity fire, ponderosa pine stands are invaded by species such as Douglas-fir, which form dense thickets and ladder fuels. Subsequent fires can climb into the canopy as uncharacteristically intense crown fires, devastating forest ecosystems.

Some environmentalists claim that recent fires in the Salmon River Canyon have not occurred outside the range of natural variability (Wilderness Watch 1998–99). However, the evidence shows otherwise. Since 1985 alone, many fires have exceeded the range of natural variability, such as the Corral Fire (118,000 acres [48,000 ha]), Chicken Fire (108,000 acres [44,000 ha]), Sliver Fire (54,000 acres [22,000 ha]), Ladder/Hida Fire Complex (49,000 acres [20,000 ha]), Long Tom Fire (30,000 acres [12,000 ha]), and French Creek Fire (15,000 acres [6,000 ha]). All of these fires—some of which burned as "prescribed natural fires"* in wilderness—caused unnaturally heavy mortality, destroying diverse vegetation mosaics. Such fires have drastically altered large portions of the Frank Church–River of No Return Wilderness, possibly for centuries.

Forest Ecosystems in Trouble

Rafting down the main Salmon River, you'll pass through the seemingly endless Hida Point Fire (1988), essentially now what I call a "nuclear shrub zone." The fire destroyed several of my past sample stands, where old trees had revealed a 300- to 500-year-long record of frequent low-intensity fires. In some forest types, an uncharacteristically intense fire can return old-growth forest to an early seral stage such as shrubland, which can persist indefinitely, particularly when reburned.

Some argue that the Great 1910 Burn, which spread across 3 million acres (1.2 million ha) in the northern Rocky Mountains, proves that severe fires are not unprecedented in the region. But the 1910 fires were quite different from the recent Salmon River



Under droughty conditions, fuel buildups are less prevalent in south-facing ponderosa pine stands in Idaho's Salmon River Canyon (top right). By contrast, in the absence of recurring fires, heavy ladder fuels encroach on north-slope ponderosa pines (bottom). Photos: Courtesy of Steve Barrett, Kalispell, MT, ©1983.

* *The term* prescribed natural fire *has been replaced by the term* wildland fire use *(NIFC 1998).*

Wilderness means fostering natural communities that evolved over thousands of years, often in tandem with human-caused fires.

Canyon fires. Although stand-replacing fires have long been common in northern Idaho, a series of fires as severe as those between 1889 and 1934 is akin to a 1,000-year flood. The fires in that 45-year period coincided with one of the most severe long-term drought eras recorded by tree rings since the late 1600's. Some of the fires, including those in 1910, were also the result of mass lightning ignitions merging because of strong winds. Accordingly, the vast shrubfields that persist in northern Idaho today—prime elk habitat—resulted from severe reburns produced by a historical anomaly.

The recent wildland fires in central Idaho's drier forests occurred under very different circumstances. There was no severe drought coinciding with unusual fire weather. Instead, burning conditions were average to above average, like those that produced low-intensity fires before 1900. The uncharacteristically intense fires that nevertheless occurred were largely due to altered fuel conditions. And because the area's lower elevation forests did not evolve with frequent severe fires, it remains unclear how they will respond after heavy burning. I doubt, however, that they will support the same array of species as before 1900.

Prescribed Fire for Wilderness Management

Today, land managers are increasingly using prescribed fire to obtain desired management results, even in some remote natural areas. The goal, as I understand it, is not to supplant lightning fires, but rather to ease their inevitable return to drainages where fire exclusion has promoted unnatural fuels. Some argue that setting fires in wilderness areas is "highly impactive" and therefore improper. However, returning fires to a fire-dependent ecosystem simply cannot be compared to such highly artificial interventions as liming lakes to offset acid rain. In fact, American Indians ignited fires in many ecosystems whenever it suited their needs. Therefore, many fire-dependent communities evolved with frequent human-caused fires.

Floating through Idaho's Salmon River Canyon, one can see open stands of ponderosa pine on dry south slopes (left foreground) and the aftermath of the severe Hida Point Fire in 1988 (background), where ladder fuels built up on moist north slopes. Photo: Courtesy of Steve Barrett, Kalispell, MT, ©1998.

Controversy about burning in wilderness stems, in large part, from differing philosophies. The enabling law, the Wilderness Act of 1964, provides little management direction other than vague wording such as leaving wilderness areas "untrammeled." Although such terms might reasonably seem to dictate that wilderness managers should do nothing to control nature, many wilderness areas today can hardly be described as natural. Decades of fire exclusion—perhaps the epitome of human attempts to control nature—have so drastically altered some areas that the original Indian inhabitants would scarcely recognize them.

To me, wilderness does not mean tolerating mutant ecosystems of our own making. Instead, it means fostering natural communities that evolved over thousands of years, often in tandem with human-caused fires. If wilderness, as some might have it, is to be nothing more than pretty scenery without mitigating action by thoughtful management, then species will surely continue to decline. And primeval wilderness itself, land

that sustained the first nations for 10,000 years and awed European explorers with its splendor, might continue to go the way of the buffalo. At least part of that diminishing splendor can be restored, both for its intrinsic value and for future generations, with the help of prescribed fire.

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Wildland Fire Fatality Report Available

FOREST SERVICE TECHNOLOGY & DEVELOPMENT PROGRAM

Dick Mangan

From 1990 to 1998, 133 individuals died in 94 separate incidents related to wildland fire activities in the United States. The USDA Forest Service's Missoula Technology and Development Center (MTDC) in Missoula, MT, has released a report analyzing those incidents and making recommendations that wildland fire managers can use to help reduce the number of future fire-related fatalities.

Dick Mangan is the program leader for fire, aviation, and residues, USDA Forest Service, Missoula Technology and Development Center, Missoula, MT.

The report groups fatalities by cause, geographic area, and organizational affiliation of those killed. For example:

- The main causes of death were burnover (29 percent), aircraft accidents (23 percent), and heart attack (21 percent).
- Most burnovers occurred during initial attack and, after fires escaped, during the transition to full extended attack.
- Failure to heed the 10 Standard Fire Orders, 18 Situations That Shout "Watch Out," and 9 Guidelines for Downhill Line Construction contributed to many fatalities, as did improper use of personal protective equipment (PPE).

To help reduce the number of fire-related fatalities in the future, the report makes specific recommendations for improvements in the areas of individual responsibility, training, strategy and tactics, and PPE. The report can be downloaded from the Forest Service Intranet at <http://fsweb.mtdc.wo.fs.fed.us> and from the Internet at <http://www.fs.fed.us/fire/safety>. To obtain a hard copy of the report, contact the USDA Forest Service, MTDC, Building 1, Fort Missoula, Missoula, MT 59804-7294, 406-329-3900 (voice), 406-329-3719 (fax), pubs/wo,mtdc (IBM e-mail), pubs/wo_mtdc@fs.fed.us (Internet e-mail). ■

Fire Use Training Academy Completes First Year

Mary Zabinski and Brad Washa

The Southwest Fire Use Training Academy (FUTA) is a new interagency program blending classroom training and field experience in prescribed and wildland fire use with the fuels management programs of different land management agencies throughout the Southwest. As its name implies, FUTA focuses on fire use. The interagency Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide defines fire use as "the combination of wildland fire use and prescribed fire application to meet resource objectives" (NIFC 1998). The Academy offers training in the full array of fire use techniques available to wildland fire managers today.

Interagency Training

Hosted by the Cibola National Forest (headquartered in Albuquerque, NM), the Academy is the result of a memorandum of understanding for interagency cooperation among:

- The Southwestern Region of the USDA Forest Service, including the 11 national forests in the region;
- The Albuquerque, Navajo, and Phoenix Area Offices of the USDI Bureau of Indian Affairs (BIA);

Mary Zabinski is a writer/editor for the USDA Forest Service, Southwestern Region, Public Affairs Office, Albuquerque, NM; and Brad Washa is a fuels specialist for the USDI Bureau of Land Management, Medford District, Medford, OR.

The Academy exposes trainees to the full spectrum of interagency programs and fuel types across the Southwest, preparing them to be future fuels program managers.

Forest Service District Ranger Pam Brown applies the terra torch to a grassland burn during a Southwest Fire Use Training Academy (FUTA) project on the Kiowa National Grassland, NM. Photo: FUTA, Albuquerque, NM, 1999.

"The Academy allowed me in 10 weeks to accomplish what would otherwise have taken me several years of training on the district."

–Donna Nemeth, fire information specialist

- The Arizona and New Mexico State Offices of the USDI Bureau of Land Management (BLM);
- The Intermountain Region of the USDI National Park Service (NPS); and
- The Southwestern Region of the USDI U.S. Fish and Wildlife Service.

The first session ran for 10 weeks in fall 1998 and the second session for 8 weeks in spring 1999; the third session is scheduled for fall 1999. The 45 participants who finished the first two FUTA sessions worked on completing individual task books leading to qualification within the prescribed fire qualification system.

Courses and Projects

The Academy, which is run by a lead coordinator and three field coordinators, offers several courses developed by the National Wildfire Coordinating Group (NWCG) as a core curriculum (see sidebar on page 26). The core curriculum differs for each session, depending upon program and trainee needs. Practical training, in the form of short courses, was developed in conjunction with prescribed fire managers throughout the Southwest, many of whom were able to offer their expertise as instructors. Training sites for the short courses were also selected to accommodate the needs of local and regional prescribed fire managers as well as the FUTA schedule.

Low-intensity night burning in ponderosa pine on Mount Trumbull formed part of the FUTA training project on the BLM's Arizona Strip District. Photo: FUTA, Albuquerque, NM, 1999.

The Academy offered, in addition to its core courses, several other NWCG courses. These additional NWCG courses were not restricted to FUTA attendees. Participants included 50 to 65 other fire management and resource personnel.

FUTA attendees were split into three modules, with a field coordinator from the Academy as the supervisor for each module. The modules functioned together in training and then traveled to various locations in Arizona and New Mexico for specific projects with different agencies, including the BLM, Forest Service, and NPS (table 1). Each module was integrated into a local burn organization to meet trainees' needs and to maximize their training experience while assisting the local unit.

The training facility in Albuquerque is located at the Albuquerque Mobilization Center, which serves as a training site and gathering point for the Academy. Open during the fire season for mobilizing people and equipment in response to incidents, the Center has been adapted to accommodate Academy needs. Locations throughout the Southwest serve as additional training sites.

Objectives

The Academy's main objective is to create a program that meets national qualification guidelines for both training and experience. "Our workforce and skill pool are shrinking," explained Jerome Macdonald, FUTA program manager. "The program is exposing trainees to the full spectrum of interagency programs and fuel types across the Southwest, honing their skills and experience in a focused, accelerated course to

Table 1—*Project accomplishments by the Southwest Fire Use Training Academy in its fall 1998 and spring 1999 sessions.*

Project Name	*Location*[a]	*Agency*	*Dates*	*Acres (ha)*	*Fire Behavior Fuel Model*[b]	*Personnel Assigned*	*Person Hours*	*Project Role*	*Complexity*[c]
Hermosa	Black Range RD, Gila NF	Forest Service	06/23–25/98	11,500 (4,650)	2, 6, 8	1	30	Support	I
Senorita	Albuquerque Field Office	BLM	09/21–23/98	800 (320)	2, 4	7	210	Support/ training	II
San Juan	Jemez RD, Santa Fe NF	Forest Service	09/22–25/98	7,200 (2,900)	8–11	22	869	Support/ training	I
Swamp Booth	Quemado RD, Gila NF	Forest Service	10/5–9/98	400 (160)	2, 11	8	315	Support/ training	II
Crown King	Bradshaw RD, Prescott NF	Forest Service	10/5–10/98	150 (60)	2, 4	7	445	Support/ training	II
Chiminea	Saguaro NP	NPS	10/7–12/98	2,000 (800)	2, 6, 9	8	720	Support/ training	II
Sheppard	Reserve RD, Gila NF	Forest Service	10/16–19/98	2,100 (840)	2, 9–11	15	667.5	Support/ training	II
Priest Canyon Fuelwood	Mountainair RD, Cibola NF	Forest Service	10/19–20/98	300 (120)	2, 13	21	269	Support/ training	III
Micro	Mt. Taylor RD, Cibola NF	Forest Service	03/1–3/99	300 (120)	9	18	574	Support/ training	II
Upper Frijoles	Bandelier NM	NPS	03/3–6/99	1,400 (570)	9	22	798	Support/ training	III
Indian Peak	Black Range RD, Gila NF	Forest Service	03/15–18/99	600 (240)	2, 9	20	1,271	Support/ training	II
Wilson Canyon	Albuquerque District	BLM	03/01–31/99	130 (53)	2, 4	11	418	Support/ training	II
Kiowa Grasslands	Kiowa NG	Forest Service	03/23–24/99	1,400 (570)	1	14	353	Support/ training	II
Barbero	Pecos RD, Santa Fe NF	Forest Service	03/23–25/99	2,000 (800)	2, 9	7	221	Support/ training	II
Rye Flats	Arizona Strip District	BLM	03/28–29/99	30 (12)	9	5	293	Support/ training	II
Lone Mountain	Big Bend NP	NPS	04/4–10/99	600 (240)	2, 6	12	994	Support/ training	II
Guadalupe	Guadalupe RD, Lincoln NF	Forest Service	04/5–12/99	2,500 (1,000)	2, 6	9	360	Support/ training	II

a. NF = National Forest; NG = National Grassland; NM = National Monument; NP = National Park; RD = Ranger District.
b. 1 = short grass (1 foot [0.3 m]); 2 = timber (grass and understory); 4 = chaparral (6 feet [1.8 m]); 6 = dormant brush, hardwood slash; 8 = closed timber litter; 9 = hardwood litter; 10 = timber (litter and understory); 11 = light logging slash; 13 = heavy logging slash. See Anderson 1982.
c. I = Complex/High; II = Intermediate/Moderate; III = Basic/Low. See Anderson 1982.

prepare them to be future fuels program managers."

Training is individually tailored to fit each trainee's experience level. "Our goal is not to make everybody 'burn boss' qualified," said Paul Womack, field coordinator for FUTA's fall 1998 session. "For those who came with task books for burn boss, we work on those. All task books are initiated from the home unit. But the focus is on meeting each trainee's specific needs."

FUTA trainees conduct a spotted owl monitoring survey in mixed-conifer forest on the Jemez Ranger District, Santa Fe National Forest, NM. Photo: FUTA, Albuquerque, NM, 1999.

A Forest Service employee on the Guadalupe Ranger District, Lincoln National Forest, NM, shows FUTA trainees Elthie Kee, Jr. (center) and Sterling Littlegeorge (right) how to use a fusee launcher. Photo: FUTA, Albuquerque, NM, 1999.

Donna Nemeth, a fire information specialist for the Forest Service, Cibola National Forest, Mount Taylor Ranger District, Grants, NM, who graduated from the first session and helped organize the second, said, "It was an extremely supportive environment to learn in. It's allowed me in 10 weeks to accomplish what would otherwise have taken me several years of training on the district."

Macdonald attributes the program's initial success to the support of natural resource agencies throughout the Southwest and the efforts of detailers who helped put theory into practice. For FUTA's first two sessions, these detailers included:

- *Fall 1998—*
  - Lead Coordinator Rich Dolphin, Forest Service Asheville Hotshots, National Forests of North Carolina;
  - Field Coordinator Mike Sanchez, BIA Southern Pueblos Agency, Albuquerque, NM;
  - Field Coordinator Brad Washa, BLM Medford District, Medford, OR; and
  - Field Coordinator Paul Womack, Forest Service, Gila National Forest, Black Range Ranger District, Truth or Consequences, NM.
- *Spring 1999—*
  - Lead Coordinator Danny Kellogg, Forest Service, Tonto National Forest, Cave Creek Ranger District, Cave Creek, AZ;
  - Field Coordinator Tony DeMasters, Boise BLM Smokejumpers, National Interagency Fire Center, Boise, ID;
  - Field Coordinator Bela Harrington, Santa Fe Interagency Hotshot Crew, Santa Fe, NM; and

– Field Coordinator Jeff Vanis, Forest Service, Coconino National Forest, Sedona Ranger District, Sedona, AZ.

The Academy's continued success hinges on enlisting trainees and projects throughout the Southwest, including Arizona, New Mexico, and southern Colorado. If your unit is interested in sending a trainee or receiving additional support for a prescribed fire project, contact Jerome Macdonald, Cibola National Forest, 2113 Osuna Road, NE., Suite A, Albuquerque, NM 87113-1001, 505-346-2650 (voice), 505-346-2633 (fax), jmacdonald/r3, cibola (Forest Service IBM e-mail), jmacdonald/r3_cibola@fs.fed.us (Internet e-mail). For a full description of the Southwest Fire Use Training Academy, access the FUTA Website at the Southwest Area Wildland Fire Operations homepage under "Fire Management" at <http://www.fs.fed.us/r3/fire>.

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Fire Use Training Academy Courses

In its first year, the Southwest Fire Use Training Academy offered a curriculum of core courses developed by the National Wildfire Coordinating Group (NWCG); short courses for practical training developed in conjunction with prescribed fire managers throughout the Southwest; and additional NWCG courses.

Core NWCG courses included:

- S–244, Field Observer;
- Rx–230/S–234, Ignition Operations;
- Rx–300, Prescribed Fire Burn Boss;
- Rx–340, Introduction to Fire Effects; and
- Rx–450, Smoke Management Techniques.

Topics for short courses included:

- Technology transfer (BEHAVE, FARSITE, RERAP, FOFEM, SASEM, and NPSPUFF);
- Portable fire weather station use, Fire Weather Plus, and DTN;
- The National Environmental Policy Act process;
- Burning in the wildland–urban interface and working with news media;
- Value/risk assessments;
- Fuels inventory and fuel moisture sampling;
- The Prescribed Fire Qualifications and Training System;
- Global positioning system mapping;
- Prescribed fire operations, including ground-applied retardant, terra torch, helitorch, and plastic sphere dispenser operation;
- Public contact plans for burning in the wildland–urban interface;
- Wildland fire use planning (wildland fire implementation planning, fire management planning, and wilderness fire use);
- Interagency policy and agreements; and
- Spotted owl monitoring surveys in mixed-conifer forest.

Additional NWCG courses (not restricted to Academy trainees) included:

- D–110, Dispatch Recorder;
- S–200, Initial Attack Incident Commander—ICT4;
- S–390, Introduction to Wildland Fire Behavior Calculations;
- S–490, Advanced Fire Behavior Calculations;
- ICARS—Incident Cost Unit Leader; and
- CREP—Crew Representative.

Those Really Bad Fire Days: What Makes Them So Dangerous?

Dan Thorpe

After some fires, you often hear comments like this: "There was no way to catch that thing," or "We couldn't have caught that fire even if we'd been there when it started." Unfortunately, such comments are all too often true. In southern Oregon, we started to ask why that was so and what we could do about it. Why do we catch every fire on some days but lose control of fires right from the start on others, even when conditions are apparently the same?

The Problem Fires

The Southwest Oregon District of the Oregon Department of Forestry has about 2 million acres (800,000 ha) and a quarter of a million people. It ranges in elevation from about 500 feet (150 m) in the Rogue River corridor to more than 6,000 feet (1,800 m) in the Cascade and Siskiyou Mountain ranges. The valleys are characterized by annual grasses; at middle elevations, brushy fuels prevail; and second-growth coniferous forest dominates above about 2,500 feet (750 m). Landownership is divided among rural residents, industrial forestry operators, small nonindustrial landowners, homeowners in the wildland–urban interface, and the Bureau of Land Management, which contracts with the State of Oregon for fire protection. National forests border the district in the west and east. The district handles more than 1,000 alarms annually, of which about 250 are statistical (bonafide) wildland fires and the rest smoke chases, mutual-aid calls, and no-action responses. About 25 percent of the fires are caused by lightning and the rest by humans. Fire seasons typically run from late May through mid-October and average about 150 days.

Dan Thorpe is the unit forester for the Southwest Oregon District, Oregon Department of Forestry, Central Point, OR.

> Why were we catching some mid-elevation fires but losing others under what seemed to be identical circumstances?

On the Southwest Oregon District, we began by mapping past fires that had escaped initial attack. Then we asked our supervisors and firefighters how we could have stopped each fire. All agreed that some fires had been impossible to control during initial attack, no matter how many resources we threw at them; but on others, the right resource at the right time would have made the difference between quickly controlling the fire and watching it grow into a project fire. We compared the answers we got to the results of our computer-modeled initial-attack analysis through the National Fire Management Analysis System. Interestingly, the answers and results corroborated each other—anecdotal evidence from our managers agreed with our computer models.

Next, we tried to isolate the common threads among the escaped fires. On a planimetric map, we looked for a common geographical feature that contributed to the escapes. Did a wind corridor, a lightning alley, a roadless area, or steep slopes contribute to preventing control?

When we overlaid the large fires with some crude fuel typing, we found that the major fires—the ones responsible for 90 percent of our total acres burned—all started in the mid-elevation zone (fig. 1). Further analysis revealed that we were very successful in controlling the grass fires in the valley zone. In fact, 96 percent of the valley fires were controlled at 10 acres (4 ha) or less. The same was true for the fires in the upper elevation coniferous forest. Although the coniferous zone had more lightning ignitions than the valleys, we succeeded in holding 94 percent of the upper elevation fires to 10 acres (4 ha) or less. So why were we less successful in the mid-elevation zone?

We began to describe what was different about the mid-elevation zone so we could later evaluate potential changes using the

By integrating the Haines Index with information on the fuel condition, we identified 10 days when high fire intensities were likely.

Figure 1—*The 1981 Tin Pan Peak Fire is an example of a plume-dominated fire burning in brushy fuels in the mid-elevation zone. Such fires are responsible for 90 percent of the total acres burned in the Southwest Oregon District. Photo: Southwest Oregon District, Oregon Department of Forestry, Medford, OR, 1981.*

computer models. We discovered four major differences:

1. The fuel type was brush rather than timber or grass;
2. Slopes were steeper in the mid-elevation zone—frequently too steep for engines and dozers to be fully effective;
3. Because the mid-elevation zone was in the thermal belt, average temperatures were higher and the relative humidity was lower; and
4. The road system was much less developed in the mid-elevation zone, due to steeper slopes and fewer timber resources.

These four factors contributed to greater contiguous fuel beds, longer response times, higher fire intensities, and greater resistance to control. None of this was news to our fire managers. During their careers, they had controlled hundreds of fires in the mid-elevation zone. The real question was this: Why were we catching some mid-elevation fires but losing others under what seemed to be similar circumstances?

The Atmospheric Factor

The answer came from the atmosphere by way of the Haines Index. Historically, our large fires frequently occurred during a significant weather event that can now be measured in terms of factors other than just wind or lightning. The Haines Index allows us to determine what the atmosphere is doing in terms of temperature and lapse rate (the rate at which temperature changes with changing height in the Earth's atmosphere). Changes in the atmosphere have regional effects, and we found it interesting to note that our national forest neighbors frequently had trouble with large, plume-dominated fires on the same days that we did. As a result, resources for extended attack frequently became limited due to their use elsewhere in our region. In particular, fire retardant aircraft have often been busy on fires elsewhere right when we needed them.

By integrating the daily Haines Index with information on the daily and seasonal condition of our fuels, we were able to identify days when high fire intensities were more likely. We completed analysis to determine normal curing dates for annual grasses and the bottoms of the live fuel moisture curves. We then compared these data with data on the thousand-hour fuels to obtain indices of extreme fire danger. By examining past Haines Indices, we determined that the district would have about 10 days per year when the Haines Index was high enough during periods of extreme fire danger to significantly change fire behavior, making a fire much more difficult to control. We dubbed the 10 bad fire days "Ira days" after Ira Rambo, the princi-

Our board of directors enthusiastically embraced the idea of spending money on those bad fire days to save money in the long run through preparedness.

pal author of our project. Later, we formalized the term by making it into the acronym "IRA" (Increased Resource Availability).

So now we knew what type of days were really our worst. The National Weather Service agreed to give us a daily prediction of the next day's Haines Index, providing us with at least 12 hours' advance notice whenever one of those really bad fire days might be coming. Now it was time to put the information to practical use. But how?

Our Response

We took the same approach we do in dealing with the threat of lightning: we increased our available resources. We asked our fire managers, "What do you need in the mid-elevation zone to control a fire sooner on days when plume-dominated fires are likely?" Again, the answers were corroborated by our computer models. On those bad fire days—the IRA days—we found that we needed:

- Additional aircraft, and sooner;
- Larger engine crews (three people per type 6 engine rather than two);
- Air attack to improve crew safety and aircraft efficiency; and
- Additional dozers (more than just two), and sooner, for initial attack.

But additional resources would come at a cost—up to $5,000 per day on 10 days per year. Was it worth it?

The answer was a resounding yes. A break-even examination found that if we stopped just one fire in 100 years from becoming a project fire, we would still save the taxpayers money! Put another way, if we spent an additional $50,000 per year, we had 100 years to be successful and still make it pay. Our board of directors enthusiastically embraced the idea of spending money on IRA days to save money in the long run.

We also made a few other changes that cost little or nothing. On IRA days, we now:

- Keep resources patrolling in the mid-elevation zones to minimize response times on potential problem fires (and to help keep fires from starting);
- Automatically order retardant;
- Immediately launch our type 2 contract helicopter for initial attack;
- Preassign structural task forces and liaisons; and
- Immediately notify cooperators of fire starts.

We discussed our findings with our cooperators, who embraced our proposed response and changed their methods accordingly. Rural fire districts agreed to increase staffing on IRA days to cover the valley zone while our crews patrol the mid-elevation zone. Landowners and our Federal cooperator agreed to provide staffing for additional engines on IRA days and to have dozers prepared to respond immediately from logging sites. The USDA Forest Service, which manages the fire retardant program in Oregon, agreed to keep an airtanker locally available on IRA days.

Wildland agencies have known about and successfully used the Haines Index for years. The concept of IRA days now allows us to integrate the Haines Index into our daily preparedness. For more information on the concept of IRA days, contact Dan Thorpe, Oregon Department of Forestry, 5286 Table Rock Road, Central Point, OR 97502, 541-664-3328 (voice), 541-776-6260 (fax), dthorpe@odf.state.or.us (e-mail).

Acknowledgments

The author wishes to thank Forest Officer Ira Rambo for leading the project team that developed the concept of IRA days; Protection Planner Jim Wolf for participating on the project team; Southwest Oregon District protection and management staff for contributing to the project team's work; and National Weather Service staff for collaborating with the project. ■

The Consumption Strategy: Increasing Safety During Mopup

Tom Leuschen and Ken Frederick

For many years, the wildland fire community has known that mopping up a fire can be just as dangerous as containing and controlling it. Unfortunately, we have not always done the best job in mitigating the hazards that firefighters are exposed to during this important phase of fire suppression.

A new approach is now available for assessing the need for, and accomplishing, mopup on wildland fires. Known as the consumption strategy, the new approach departs from traditional thinking by using the natural tendency of a fire to burn itself out by consuming its fuel. The consumption strategy realistically compares the risks and consequences associated with an escaped fire to the risks and consequences associated with the hazards firefighters typically face during mopup, which tend to be related to gravity (falling snags, rolling materials, and tripping and falling). The strategy is designed to improve firefighter safety while still suppressing a fire.

The consumption strategy is planned during containment and implemented during control or mopup. It includes these steps (fig. 1):

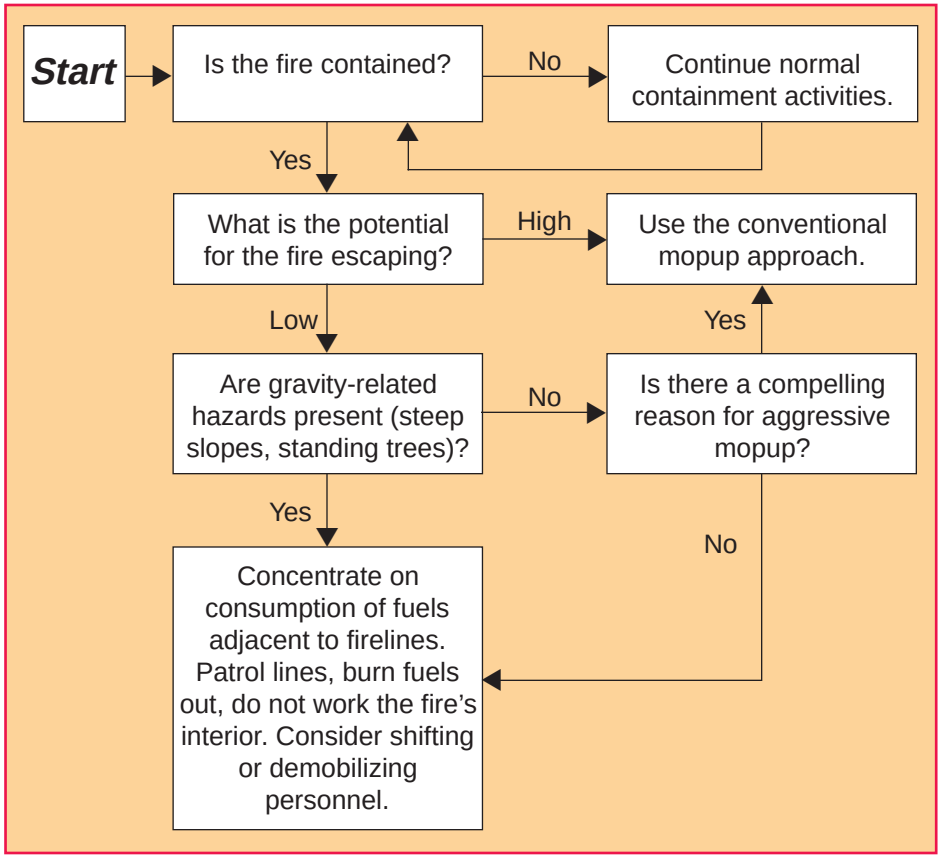

Figure 1—*Consumption strategy decision tree, for application separately to each section of the fire.*

1. Mopup strategy and standards flow from a determination made about the fire's potential to escape across firelines after it is declared contained.
2. Sections of the fire that show a high potential for escape receive the normal mopup treatment.
3. Sections of the fire that do not show a high potential for escape and that contain significant gravity-related hazards are not considered for lengthy operational assignments that could place crews in harm's way.
4. Sections of the fire avoided due to gravity-related hazards are still patrolled or otherwise monitored. "Patrolling" means that crews or scouts hike along firelines in the avoided areas (staying alert for falling or rolling material) to check for escapes of the fire across firelines but not to extinguish flames or embers within the firelines.

Tom Leuschen is the owner of Fire-Vision Enterprise Team and a former fire and fuels specialist for the USDA Forest Service, Okanogan National Forest, Okanogan, WA; and Ken Frederick is an information assistant for the Forest Service, Wenatchee National Forest, Chelan Ranger District, Chelan, WA.

5. Operational assignments in avoided areas can include, in addition to patrolling, tasks such as blacklining (burning fuels adjacent to firelines), flush-cutting staubs (reducing the woody stubs sticking up from the ground on firelines), trimming tree branches immediately inside the lines, and gridding (searching systematically along gridlines) for spot fires well outside of the lines. Firelines can be strengthened, as long as crews maintain good lookouts and do not linger in dangerous spots.

Origins of the Consumption Strategy

The consumption strategy originated in response to a near tragedy during the 1997 fire season. The season was relatively quiet in eastern Washington. In fact, the only project fire on the Wenatchee National Forest was the Gold Creek Fire on the Naches Ranger District in August 1997, which burned about 480 acres (190 ha) of ponderosa pine and Douglas-fir near Cliffdell, WA. During mopup on the incident, a Washington Department of Natural Resources crewmember was struck and seriously injured by a snag being felled by a sawyer. Ironically, the accident occurred when areas inside the fireline were being "snagged" for firefighter safety.

Tom Leuschen, the fire and fuels specialist for Washington's Okanogan National Forest, was on the Gold Creek Fire as a fire behavior analyst. "It occurred to me," Leuschen recalled, "that we were asking the firefighters to work in hazardous areas to do mopup when there was minimal risk of the fire escaping." By the third day of the Gold Creek Fire,

The consumption strategy for mopup exploits a fire's natural tendency to consume its fuels and burn itself out.

Leuschen had hiked the perimeter of the fire and determined that the blaze posed little threat of escaping. However, the operations and plans sections of the type 2 team managing the fire were still trying to control the fire according to standards agreed to by the local line officer and the incident management team—and that included risky mopup work inside the black.

After the accident, Leuschen and the district ranger walked out to the lines with the incident commander, safety officer, and operations section chief to take a sober look at the work. Although discussion continued to focus on how firefighters could work safely inside the lines, Leuschen questioned whether firefighters needed to work inside the black at all. Areas where firefighters had completed several shifts of mopup showed little difference in the kinds and amounts of smoldering debris from similar areas where no mopup had occurred. Residual interior smokes were not a threat to the lines. Furthermore, a large percentage of the fire perimeter consisted of sections where the fire had backed downhill; in order to escape in these areas, the fire would have to jump the lines and aggressively spread downhill, a highly unlikely eventuality. "As a result of our observations," Leuschen said, "we recommended a change in mopup standards to the line officer." The group had learned a lesson: performing mopup where it wasn't really needed had nearly cost a life.

The Gold Creek incident made it increasingly obvious that we need a strategy for assessing risk to reduce firefighters' exposure to hazards during mopup. Since the South Canyon tragedy in 1994, risk assessment has focused primarily on avoiding fire entrapments. In recent years, the wildland fire community has paid more attention to mitigating risk during containment and control (constructing and securing firelines) than during mopup. We need to rethink what mopup is. Are we out there trying to physically put out every flame and ember, or are we trying to prevent the fire from escaping control lines while those flames and embers burn out? Depending on the situation, we currently do both; but we should remember to distinguish between the two and to choose the approach that best protects our crews.

Managers' perceptions of the risks to firefighters must change with changes in a given fire. At a certain point in a fire, the primary danger facing firefighters is no longer the fire itself, but rather falling or rolling objects (fig. 2). As the fire nears containment, entrapment risk decreases but gravity-related risk increases. Trees, both live and dead, with fire in their bases become increasingly unstable; stumps roll as they lose the old, dry roots that have held them on the slope; and firefighter fatigue accumulates, reducing energy and alertness and causing more tripping and falling on steep terrain.

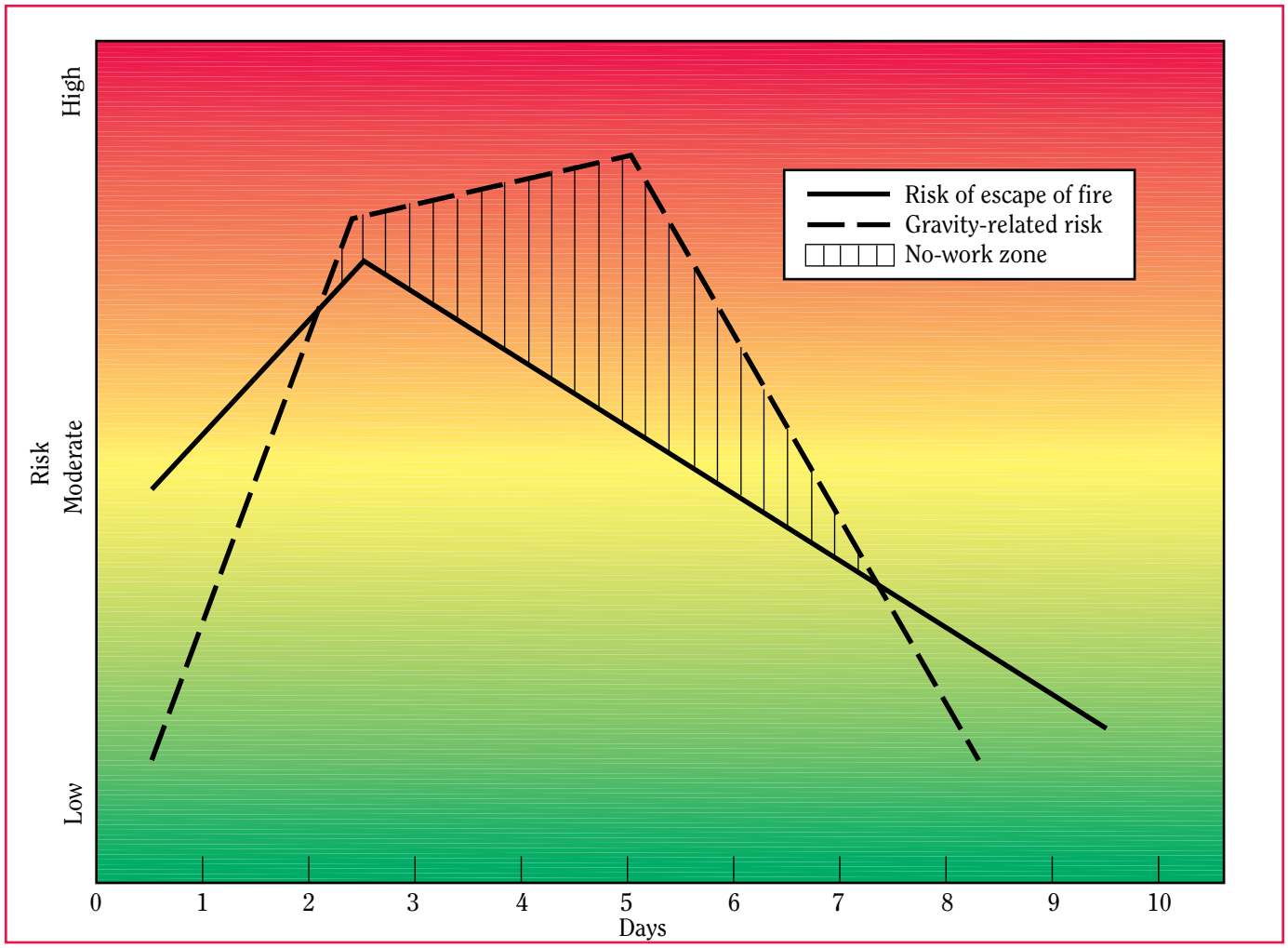

Figure 2—*Consumption strategy risk assessment on a fire in coniferous forest that is contained after 3 days. As the fire nears containment, gravity-related risks (such as falling trees, slippery slopes, and rolling rocks and stumps) exceed risks from an escaped fire. In sections of the fire where gravity-related risks exceed the risk of fire escape (the no-work zone), mopup should be avoided.*

Entrapment during mopup obviously remains a serious risk that overhead and crews must never forget. However, we must elevate our awareness of the risks to firefighters from gravity-related hazards during mopup.

Operational Success

In August 1998, the 8,500-acre (3,400-ha) North 25 Fire on the Wenatchee National Forest's Chelan Ranger District in Washington provided the first opportunity to implement the consumption strategy. A number of factors coincided to make testing possible under actual field conditions. First, Tom Leuschen was detailed to the district as the fire management officer for the summer. Second, the Central Washington Area Incident Command Team, the same team that had handled the Gold Creek Fire, was assigned to manage the North 25 Fire when it escaped initial attack. With the Gold Creek experience still fresh in their minds, the team's leaders were willing to consider a new approach. Third, District Ranger Al Murphy and Forest Supervisor Sonny O'Neal were both willing to accept the possibility of a longer lasting or larger fire if the consumption strategy were implemented. Finally, the North 25 Fire had the topographical and fuel conditions necessary for applying the new approach (fig. 3).

Implementing the consumption strategy on the North 25 Fire offered several immediate benefits:

1. Reduced risk of firefighter injury due to falling and rolling materials on steep, rocky slopes.
2. Reduced need for resources and labor. Because much of the North 25 Fire's perimeter was inaccessible by road, conventional mopup was likely to involve lots of crews, long hoselays, and significant helicopter use.

The consumption strategy saves labor and reduces costs, freeing resources for use on other incidents.

3. Reduced cost. Assisted by the consumption of available fuels, mopup would cost less than traditional, labor-intensive mopup.
4. Reduced spread of noxious weeds, particularly the diffuse knapweed (*Centaurea diffusa*). Ranger Murphy saw that tilling less soil would reduce the amount of prepared seedbed for weed propagation. "The North 25 Fire burned on both sides of one of the busiest roads on this district," he said. "The less ground we dig up, the more we prevent weeds from spreading outside of the road corridor."

The incident management team carefully briefed all operational personnel on why and how the new mopup standards were to be implemented on the fire. Even after several briefings, however, some crews still had trouble accepting the idea of merely patrolling firelines for 3 to 5 days while allowing the fire to consume fuels just inside the lines. "This approach is a cultural shift in how we manage fires," said Incident Commander Jim Furlong. "We are used to being aggressive in extinguishing fires, so being patient like this feels a little unnatural." Some crews modified their line patrol assignments by scavenging a 20-foot (6.2-m) strip of ground just inside the lines for fuel and then constructing and burning numerous small handpiles. The result was a cleanly burned and very secure blackline.

Figure 3—*A helitanker drops water on an inaccessible spot fire, part of the North 25 Fire, Chelan Ranger District, Wenatchee National Forest, WA, in August 1998. The steep terrain and poor accessibility of the site called for applying the consumption strategy, which succeeded in controlling the fire while minimizing the risks to firefighters from gravity-related hazards such as falling snags and rolling logs. Photo: Paige Houston, USDA Forest Service, Okanogan National Forest, Tonasket Ranger District, Tonasket, WA, 1998.*

According to Furlong, many crews understood that the incident management team was looking out for firefighter safety in using the consumption strategy. "The crews that picked up on what we were doing were the hotshot crews," Furlong noted. "I had a number of superintendents come up to me and thank us for using this approach." Twenty-two interagency hotshot crews from the Pacific Northwest and California were on the North 25 Fire.

The consumption strategy succeeded. About a quarter of the fire perimeter was never considered for direct attack, let alone mopup, because it was on an extremely steep, rock-strewn slope overlooking Lake Chelan (fig. 4). Around the remainder of the fire, the operations section chiefs opted for intensive mopup on only 22 percent of the firelines, based on the prevalence of unburned fuels next to the lines. For 3 to 5 days, more than 7 miles (11.2 km) of the 9.5 miles (15.2 km) of accessible perimeter were allowed to smolder under the watchful eyes of daily patrols. There were no accidents during mopup and no significant escapes. Because almost no hose was laid and operations were much less labor intensive than under the conventional mopup approach, seven crews could be freed right away for fire assignments elsewhere.

Lessons Learned

Several lessons can be learned from our experience with the consumption strategy on the North 25 Fire:

- Firefighters should mop up in areas of high gravity-related hazard only when necessary. Too often we approach mopup based on tradition and habit. Especially in an age of increasingly large fires across the West, the same safety mindset should prevail for mopup as for line construction. Sometimes it might be safer and more sensible to be vigilantly patient for a few days while a fire consumes its fuels than to aggressively put it out.
- Line officers and fire managers on project fires should reflect upon what might be a false sense of insecurity regarding how thoroughly a fire should be extinguished before the local administrative unit reassumes responsibility for the fire. Line officers should consider accepting more risk of fire escape in exchange for less risk to firefighter safety. The risk of escape is often only marginally higher under the consumption strategy.
- Fire behavior analysts should measure the potential for escape on each section of line as it is completed. Each section must also be evaluated for gravity-related hazards. These data must then be presented to the line officer for determining mopup standards.
- Although perceiving mopup as putting out the fire is often appropriate, sometimes a more reasonable interpretation of mopup is making sure the fire does not cross control lines. Making this subtle distinction will help fire managers and firefighters avoid the potentially high costs of doing what the fire will likely do by itself—given just a little time.

Safety must always be our first priority in suppressing wildland fires. Applied correctly, the consumption strategy offers a safer, more cost-effective means of achieving the same objective—wildland fire suppression. For more information on the consumption strategy, contact Ken Frederick, Information Assistant, Chelan Ranger District, Wenatchee National Forest, 428 W. Woodin Ave, Chelan, WA 98816, 509-682-2576 (voice), 509-682-9004 (fax), kfrederick/r6pnw_wenatchee@fs.fed.us (e-mail). ■

Figure 4—*The North 25 Fire burns deep in Box Canyon on the south shore of Lake Chelan, Chelan Ranger District, Wenatchee National Forest, WA, in August 1998. About a quarter of the fire perimeter was never considered for direct attack, let alone mopup, because it was on an extremely steep, rock-strewn slope overlooking the lake. The consumption strategy is well suited for consideration on such sites. Photo: Paige Houston, USDA Forest Service, Okanogan National Forest, Tonasket Ranger District, Tonasket, WA, 1998.*

Using Felled Timber as Water Bars To Control Postfire Erosion

John Winchester

Wildland fires that remove protective canopy and consume vegetation on the forest floor leave burned areas susceptible to erosion. One measure to reduce erosion until ground cover is reestablished is to create water bars across exposed slopes.

Water, in and of itself, does not erode soil. It is the velocity of water that provides the energy to move soil. The purpose of a water bar is to pool, slow, or redirect moving water, reducing its velocity so it will drop the sediment it is carrying and not pick up any more in the immediate area. Water bars can also be used to break up water flowing in rills (channels small enough to be removed by standard farming machinery [Dunne and Leopold 1978]) and make it flow in sheets, thereby reducing the power available for channel formation.

Like water bars on hiking trails, which divert water to prevent erosion of the footpath, water bars on open soils are susceptible to rapid wear from wind, rain, and flowing water. One way to increase their longevity is to reinforce them with large, solid materials such as rocks or logs. In forested areas, water bars can be easily fortified with felled trees killed by the fire. Although felled-tree water bars might not be as quickly erected as silt fence, they have several advantages:

- No material costs.
- No need for transporting materials to the site (which is particularly advantageous for remote or rugged sites).
- No leftover hazards. Unlike silt fence, which can leave hazardous metal posts and synthetic fabric for decades after placement, felled-tree water bars will be covered by returning vegetation and eventually decompose into the landscape.

> To effectively disrupt the flow of water downhill, tree trunks need to be firmly in contact with mineral soil.

After 10 years of monitoring felled-timber water bars in Colorado's Black Tiger Gulch, we can now assess their performance and recommend specific construction methods to improve their effectiveness.

Placing Water Bars in Black Tiger Gulch

At about 12:30 on the afternoon of July 9, 1989, a wisp of smoke began to curl up from the forest floor outside a small home west of Boulder, CO. The fire rapidly spread into thick stands of ponderosa pine and raced uphill. Eight minutes later, the Sugar Loaf Volunteer Fire Department was dispatched to what they were told was a small grass fire—a fire that had grown beyond control even before they arrived on the scene. So began the Black Tiger Fire, which consumed 44 structures and 2,100 acres (850 ha) of coniferous forest in 4 days (NFPA n.d.).

After the fire, concern quickly turned to the potential for erosion, particularly since the average slope across the burned area is 23 percent. Orchestrated by the Colorado State Forest Service, several agencies began implementing a variety of erosion control measures in the steepest parts of the watershed, including aerial seeding of grass seed, installation of silt fence, and cross-slope tree felling to create water bars.

Efforts to control erosion were focused on the lower slopes of Black Tiger Gulch, both because it was the steepest terrain burned and because a filter strip at the bottom of the basin would help trap sediment moving off the upper parts of the basin. Since the area was not going to be logged for salvageable timber killed in the fire, there were plenty of pine, spruce, and fir trees from 6 to 18 inches (15 to 45 cm) in diameter available for use in constructing water bars. Silt fence was installed on a limited basis, and cross-slope tree felling was carried out over approximately 25 acres (10 ha) in the lowest portions of the watershed.

John Winchester is a water resources engineer for Hydrosphere Resource Consultants in Boulder, CO.

In the fall of 1989, trees were cut in Black Tiger Gulch for the purpose of making water bars. Trees that did not fall across the slope were placed that way by hand. To keep the tree trunks from being suspended off the ground, all branches were flush cut with the trunk and the slash was cleared. The limbless trunks were prevented from rolling downhill by placing some trees against stumps and chocking others with rocks on the downhill sides. Then Black Tiger Gulch was left to heal on its own.

Observation of Postfire Erosion

Erosion in Black Tiger Gulch was not as severe as some had feared, partly due to erosion control and partly due to the thin, rocky soils. Although one slug of sediment washed into Middle Boulder Creek during an unusually heavy rainstorm in the summer of 1989, there have been no slope failures and no large-scale erosion or sedimentation problems. Ten years after Black Tiger Gulch burned, grasses again hold the sandy soil in place. Small stands of aspen have returned, some with trees up to 12 feet (3.7 m) tall.

Observations were made in four key areas regarding erosion in Black Tiger Gulch:

1. The placement of trees for successful water bars,
2. The necessary stabilization of trees used as water bars,
3. The timing of soil movement, and
4. The optimal number of water bars required to hold soil in place.

Tree Placement. The placement of the tree trunk is key to a successful water bar. Only one location was found where water bars succeeded in trapping and holding the soil. Unfortunately, this location was at the bottom of Black Tiger Gulch, and the trees were washed away after the heavy rainstorm during the first summer. With that one exception, no water bars showed any sign of water pooling or sediment deposition. By contrast, silt fence that was properly installed shortly after the fire both pooled water and retained sediment.

Why did the water bars fail where silt fence succeeded? When the trees were felled across the slopes, they were not placed in continuous contact with the ground. Figure 1 shows a typical slope with felled

Figure 1—*Ineffectively installed water bars in Black Tiger Gulch, CO. After a severe fire in 1989, trees were felled cross-slope for erosion control. Notice that between May 1990 (left) and May 1997 (right), no sediment accumulated behind the water bars. Inadequate installation permitted water flowing downhill to form rills under the trunks, rendering them useless as water bars. Photos: Courtesy of John Winchester, Boulder, CO, ©1990 and ©1997.*

trees in May 1990 and again in May 1997. Notice that no sediment accumulated behind these trees. Even where trunks were in relatively continuous contact with the soil, after rills formed under the trunks, they became useless as water bars. To effectively disrupt the flow of water downhill, trees need to be firmly in contact with the soil. Contact can be made by digging a cup trench so the trunk is somewhat recessed into the slope and backfilling against the bole with soil or—where variations in the trunk make this infeasible—using silt fence or filter fabric to cover gaps between the tree trunk and the ground. If fabric is used, it should be well anchored to both the tree and the ground. Ideally, there should be a depression on the uphill side of the tree that will provide a place for water to pool and sediment to settle out and be stored. The bigger the depression, the better.

Water bars must be anchored solidly enough to stay in place until vegetation has become well established.

Tree Stabilization. Over time, some of the trees moved downhill, making them useless as water bars. Some crept slowly downhill as branches and rocks supporting them gave way or were pressed into the soil. Others moved suddenly when their supports abruptly failed. To be effective, water bar construction must provide sufficient support to hold the trunks in place until vegetation has stabilized the soil—in the case of Black Tiger Gulch, after about 2 to 3 years.

Timing. Most of the material that moved in Black Tiger Gulch as a result of the fire did so in the first year after the fire. Figure 2 shows sedimentation behind a silt fence in May and July 1990 and again in May 1997 (at the same elevation and approximately 100 yards [109 m] north of the area shown in figure 1). Notice that accumulated sediment was much heavier in July 1990 than in May 1997. This makes sense intuitively, because the more time passes, the more vegetation is

Figure 2—*Silt fence installed in Black Tiger Gulch, CO, after a severe fire in 1989. Notice that accumulated sediment is much heavier in July 1990 (left) than in May 1997 (right). Because most erosion occurs during the first year after a fire, water bars are most effective for postfire erosion control when installed shortly after a fire. Photos: Courtesy of John Winchester, Boulder, CO, ©1990 and ©1997.*

Water bars that are installed shortly after a fire are much more likely to catch sediment than ones installed after the first season.

reestablished and the more soil is held in place. Consequently, water bars that are installed shortly after a fire are much more likely to catch sediment than ones installed after the first season.

Number. Multiple rows of water bars were constructed on long slopes in Black Tiger Gulch to decrease the distance that water could travel unimpeded. Although the spacing between water bars will vary from site to site because of differences in slope, soils, native vegetation, and expected precipitation, multiple water bars might be required to effectively slow waterflow on long slopes.

Ensuring Water Bar Effectiveness

Using felled trees as water bars can be a fast and inexpensive means of erosion control. However, four measures must be taken to ensure the effectiveness of water bars:

1. Like silt fence, trees used as water bars must be in continuous contact with the ground. If the ground or tree trunk is irregular, contact must be created by trenching so the tree is partially buried in the slope and then mounding dirt against the trunk, or by installing a filter fabric on the uphill side of the tree between the ground and the tree trunk.
2. Tree trunks must be anchored firmly enough to stay in place until vegetation has become well established. Revegetation is likely to take from 1 to 3 years, depending on factors such as the local environment and the severity of the fire.
3. Water bars are most effective if they are installed as soon as possible after the fire, because soil movement decreases with time after the disturbance.
4. On long slopes, two or more water bars should be placed in a series to shorten the distance that water can travel unobstructed. The distance between water bars should also be shortened for steep slopes, erosive soils, thin or slow-growing vegetation, or areas with heavy precipitation.

For more information on water bar use and construction, contact John Winchester, P.E., Water Resources Engineer, Hydrosphere Resource Consultants, 1002 Walnut Street, Suite 200, Boulder, CO 80302, 303-443-7839 (voice), 303-442-0616 (fax), jnw@hydrosphere.com (e-mail).

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A Glimpse Into Fire Prevention History

Ken Strauss

Long before Smokey Bear, the USDA Forest Service used materials such as the brochure replicated below right* to promote wildland fire prevention. The two-sided brochure is from the files of Alfred Moore, the former alternate ranger on the Castle Creek Ranger District, Nez Perce National Forest, Grangeville, ID. Like today, many wildland fires in the 1920's and 1930's were ignited by careless hunters and anglers, often while camping. By appealing to the interest of sportsmen in preserving fish and game, the brochure seeks to prevent careless fire use.

Today, preventing careless fire use on our Nation's wildlands remains one of our top priorities. But our messages have changed. We now fully accept the natural role that fire often plays in sustaining habitat for fish and wildlife. Frequent low-intensity fire in open stands of ponderosa pine, for example, promotes browse for deer and prevents the buildup of ladder fuels that could lead to devastating crown fires followed by hillside erosion and siltation of streams, destroying spawning habitat for salmon and trout. Some types of fire are actually a boon to hunters and anglers, and we now use such fires to promote wildlife habitat on many of our wildlands. ■

Ken Strauss is the deputy director of Fire and Aviation Management for the USDA Forest Service, Intermountain Region, Ogden, UT.

* The cover photo of a fire-killed deer is similar to the one in the original brochure. Photo: Courtesy of National Agricultural Library, Special Collections, Forest Service Photograph Collection, Beltsville, MD (Leland J. Prater, 1953; 475290).

SIX RULES FOR PREVENTING FIRE IN THE FORESTS

1. Matches—Be sure your match is out. Break it in two before you throw it away.

2. Tobacco—Be sure that pipe ashes and cigar or cigarette stubs are dead before throwing them away. Never throw them into brush, leaves, or needles.

3. Making Camp—Before building a fire scrape away all inflammable material from a spot 5 feet in diameter. Dig a hole in the center and in it build your camp fire. Keep your fire small. Never build it against trees or logs or near brush.

4. Breaking Camp—Never break camp until your fire is out—dead out.

5. Brush Burning—Never burn slash or brush in windy weather or while there is the slightest danger that the fire will get away.

6. How to Put Out a Camp Fire—Stir the coals while soaking them with water. Turn small sticks and drench both sides. Wet the ground around the fire. If you can't get water stir in dirt and tread it down until packed tight over and around the fire. Be sure the last spark is dead.

GOVERNMENT PRINTING OFFICE

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

FOREST FIRES OR GAME?

"AFTER THE FOREST FIRE"

M-5020 8—5731

THE WOODS AND WILDLIFE

"Human life is absolutely dependent upon wild life and forests. Without these things we would become extinct as a race.

"If all vegetation, all wild life, and all forests should disappear to-morrow, the human race would become extinct upon the face of the earth within one year."

—James Oliver Carwood.

FIRE IS THE ANGLER'S ENEMY

In 1900 a severe fire on Slippery Brook, New Hampshire, was followed by a rain.

After the rain many dead fish were seen, presumably killed by the alkaline ashes that washed into the water.

—Aldo Leopold in American Forestry Magazine, September, 1923.

Ultimately fish depend on the smaller creatures and on plants for food.

Acquatic plants are affected by changes in quality of water.

Rising and falling water levels affect them still more.

Forest fires affect the floor of lakes and streams as much as the forest floor, though less suddenly.

—P. E. Nobbs, in Illustrated Canadian Forestry Magazine, May, 1923.

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FIRE IS RUTHLESS

For 12 years after a 50 square mile forest fire in Canada, streams which had previously been abundantly supplied contained no trout.

Most of the waters are still barren.

FIRE DESTROYS GAME FOOD

During the deep snows of winter, white-tailed deer "yard up" on North Fork, in the Flathead Forest.

In 1910 the Coal Creek–Anaconda fire burned the moss and willows on half of this yarding area. The following winter the deer yarded as usual. Seventy per cent died of starvation before spring. Many weakened deer were killed by coyotes before they had a chance to die of starvation.

LOST TO SPORTSMEN

On a single 40-acre tract of brush land in Minnesota, planted to pine, eight nests of ruffed grouse with 83 eggs were burned.

Destroyed in this fire:
Eight coveys of grouse.
Recreation for 12 men.
Potential timber for 40 homes.

Spirit Fire Rules the Earth*

Stephen W. Barrett

The year is 1697. In the Flat Long Valley, some Salish Indians are resting under the shade of Father Old Pine, a huge ponderosa pine that has marked the trail for countless generations—perhaps seven or eight centuries, no one knows for sure. But the tree's lower branches still hold the People's sacred offerings from long ago.

Rolling Thunderclap asks Dancing Red Flame, "Were you awake during the storm last night?"

"Yes, Spirit Fire has returned and the hills are coming alive."

Suddenly, Flying Ember gives a yell. "Look! Smoke on Big Mountain! When did it last burn, 4 or 5 years ago?"

"I don't recall," Flaming Needles replies happily, "but let's go up there next year. Good hunting for sure!"

Crooked Smoking Tree agrees. "Yes, and plenty of berries in that old burn my grandfather showed me, from the big Spirit Fire three generations ago."

The People revere the Big Pines as the sacred guardians of the valley. Some trees are so big that three men, fingertip to fingertip, can barely reach around the trunks.

"You mean when the Kootenais were trapped in that canyon up north?" asks Dancing Red Flame.

"Yes," replies Crying Burnt Finger, "their ghosts are still wandering near where the Great White Bears pick berries."

(Some two centuries later, Spirit Fire, now considered the enemy of man, would again sweep through the area as "The Great 1910 Burn."**)

After awhile, Rolling Thunderclap asks Crooked Smoking Tree, "Is the game drive set for tomorrow?"

The twin boys, Small Spark and Little Burning Bush, don't yet know the ways of the People. They ask the men what they are talking about. So Crying Burnt Finger explains how, after a brief ceremony, the People would form lines and torch the grass, driving the deer toward hunters hiding behind the Big Pines.

Little Burning Bush interrupts. "Wouldn't Spirit Fire hurt the People and Father Old Pine?"

Rolling Thunderclap just laughs and says, "Don't worry. The flames are small and the Big Pines have thick skin. The trees will be the happier for it, and Spirit Fire will also create more food for the animals."

The People revere the Big Pines as the sacred guardians of the valley. Some trees are so big that three men, fingertip to fingertip, can barely reach around the trunks. And the hunters often stalk deer by sneaking from tree to tree, moccasins whispering through the pinegrass.

(Two centuries later, new valley dwellers would call the big trees "Sawtimber" and log them in the name of progress. Then, in the late 1900's, some folks would call the few remaining trees "Ancient Old Growth" and revere them as museum pieces.)

Spirit Fire has been burning on Big Mountain for some hours now, creeping here and spotting there; once a sheet of flame even goes clear to the mountaintop. But the drowsing Indians don't

Steve Barrett, a consulting fire ecologist in Kalispell, MT, has studied fire history in many parts of the northern Rocky Mountains for the past 20 years.

* This whimsical sketch illustrates Indian wildland burning practices documented by many researchers, including the author (Barrett and Arno 1982) and other writers (Boyd 1999). The sketch is excerpted from Steve Barrett's "A Rocky Mountain Allegory," a fanciful fire history of Montana's Flathead Valley.

*** The 1910 fires burned 3 million acres (1.2 million ha) in the northern Rocky Mountains. A formative experience for many foresters in the fledgling USDA Forest Service, the great fires of 1910 led indirectly to the 10 A.M. Policy of suppressing all wildland fires, established in 1935. The 10 A.M. Policy was finally renounced in 1978 due to the growing realization that some forest types require periodic fires to regenerate and thrive.*

Coeur d'Alenes in Idaho in about 1845 using fire to drive deer into a lake, where hunters wait in canoes to shoot them. The painting is by a Jesuit missionary, Father Nicolas Point, who lived with various native peoples in the northern Rocky Mountains from 1840 to 1847. Point's stylized depiction of fire hunting, showing a crown fire dangerously close to the Indian encampment, probably reflects European fear of wildland fire rather than an actually observed event. The accompanying journal account on Indian fire hunting describes surface fires, not crown fires. Indians skilled and experienced in the use of fire rarely endangered their villages through wildland burning. Illustration: Courtesy of the Archives of the Society of Jesus, Quebec, Canada.

pay much mind, safe as they are under the shade of Father Old Pine.

(Some three centuries later, a new clan of people, the Smokejumpers, would spend $10 million in taxpayer money frantically trying to save luxury homes on the same mountain.)

Stirring from his nap, Yellow Lightning Brother says to no one in particular, "Look! Spirit Fire's awake on White Elk Mountain and Big Pine Ridge. Come to think of it, we haven't burned the ridge in, what, 2 or 3 years?"

"You're thinking of Crane Mountain, on the east side of the Long Deep Lake," teases Flying Ember.

Coughing Gray Smoke just laughs. "No matter, the hunting and gathering will be good all over."

Little Burning Bush is now becoming restless. "Mother told me the women would be done burning around the campsite by evening. What's taking so long?"

His father, Rolling Thunderclap, says, "Be patient, the burning ceremony always takes time."

"Father, tell me again about the time you fought the Blackfeet near Badrock Canyon," says Small Spark.

So Rolling Thunderclap proudly retells the story, probably for the 10th time. "And the fight was going badly," he concludes, "until Flying Ember and Coughing Gray Smoke torched the grass. Spirit Fire scattered the Blackfeet like fool hens in the bushes. But last year, when we crossed the Backbone to hunt blackhorns on the plains, the Blackfeet pulled the same trick on us."

Crying Burnt Finger explains how, after a brief ceremony, the People would form lines and torch the grass, driving the deer toward hunters hiding behind the Big Pines.

By now, the North Valley is filling with smoke. But the Indians don't much care, for the smoke won't linger very long.

(Three centuries later, City Folks, some 70,000 strong, would complain bitterly about smoke in the air from fires in the forest. A few would even protest to a council known as the Environmental Protection Agency.)

Crooked Smoking Tree and Horse Lightning suddenly point to the southeast. "Look! Now there's smoke in Swan Valley!"

All eyes turn to see a dark cloud billowing toward the Big Fork.

Coughing Gray Smoke says, "That must be Red Coal's band coming to the winter camp. You can tell the time is near, because he always burns the grass on his way back to the main valley."

Yellow Lightning Brother then spots a new smoke in the west, near Tallgrass Draw. "And there's Chief Black Cloud signaling for everyone to meet at the Long Deep Lake."

A few minutes later, Flying Ember tells Flaming Needles, "My band is heading down the west side of the lake the day after tomorrow. We'd better burn the hills for the deer."

"I'll do the same on the east side. We'll see who gets the bigger smoke," laughs Flaming Needles.

(Three hundred years later, someone named Fire Ecologist would find that fires had burned every few years on Crane Mountain between 1500 and 1920. But there was no sign of Spirit Fire thereafter; some say she fled when the clans of Firefighters came.)

Toward evening, Crying Burnt Finger stands up and says, "We'd better signal back to Black Cloud and Red Coal, while there's still time."

So the Indians offer a few gifts to Father Old Pine and leave, but not before Yellow Lightning Brother shows the twins how to burn the trail, clearing it for next spring.

For the rest of that fall, Spirit Fire burns throughout the Flat Long Valley, until the snows finally come. Some flames even make it to the Sun River country, deep in the heart of the Backbone. The People don't pay much mind, because they are busy preparing for the winter camp.

But, speaking in a language no human can understand, the plants and animals all talk excitedly among themselves. Grizzly Bear, king of the mountains, speaks for all his subjects. "Spirit Fire has been good to us, providing all we need to survive." Then the plants and animals gradually doze off, preparing to sleep away the long, dark winter of 1698.

Literature Cited

Barrett, S.W.; Arno, S.F. 1982. Indian fires as an ecological influence in the Northern Rockies. Journal of Forestry. 80(10): 647–650.

Boyd, R., ed. 1999. Indians, fire, and the land in the Pacific Northwest. Portland, OR: Oregon State University. 320 p.

Photo Contest

Fire Management Notes invites you to submit your best fire-related photos to be judged in competition. Winners in each category will receive awards (first place—camera equipment and a 16- by 20-inch framed copy of your photo; second place—an 11- by 14-inch framed copy of your photo; third place—an 8- by 10-inch framed copy of your photo). All contestants will receive a CD–ROM with all of the photos evaluated in the competition. In addition, we will print winning photos in *Fire Management Notes*.

Categories

- Wildland fire
- Prescribed fire
- Wildland–urban interface fire
- Aerial firefighting resources
- Ground firefighting resources
- Other (fire effects; fire weather; fire-dependent communities or species; etc.)

Rules

- The contest is open to everyone. You may submit an unlimited number of entries from any place or time.
- For every photo you submit, you must indicate only one competition category.
- Each photo must be an ***original color slide***. We are not responsible for photos lost or damaged, and photos submitted will not be returned (so make a duplicate before submission).
- You must be the photographer or own the rights to the photograph, and the photo must not have been published prior to submission.
- You must complete and sign a statement granting rights to use your photo(s) to the USDA Forest Service (see sample statement below). Include your full name, agency or institutional affiliation (if any), address, and telephone number.
- Every photo submitted must have a detailed caption (including, for example, name, location, and date of the fire; names of any people and/or their job descriptions; and descriptions of any vegetation and/or wildlife).
- Photos are judged by a photography professional whose decision is final.

Evaluation Criteria

- Photos without detailed captions or of low technical quality (for example, duplicates or photos with soft focus or showing camera movement) will be eliminated from competition.
- Evaluation will be based on such criteria as subject (does the photo tell a story?), composition, color, and patterns.

Postmark Deadline

December 15, 1999

Send submissions to:

Hutch Brown
Editor, *Fire Management Notes*
4814 North 3rd Street
Arlington, VA 22203

Sample Photo Release Statement

(You may cut out and use this statement. It ***must be signed.***)

Enclosed is/are _____ (*number*) slide(s) for publication by the USDA Forest Service. For each slide submitted, the contest category is indicated and a detailed caption is enclosed. I have the authority to give permission to the Forest Service to publish the enclosed photograph(s) and am aware that, if used, it or they will be in the public domain and appear on the World Wide Web.

Signature _____ Date _____

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